SOIL SURVEY INTERPRETATIONS for WOODLAND CONSERVATION

PROGRESS REPORT

SOUTHWEST WASHINGTON

1962

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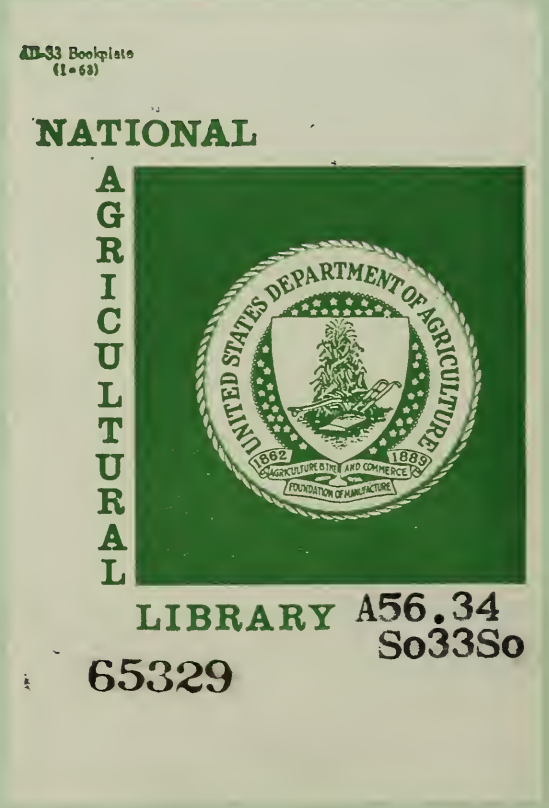

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INTRODUCTION

Southwest Washington, with its woodland-covered, rolling, hilly landscape, has many kinds of soil. Each soil has a characteristic potential productivity and distinctive problems of management and particular reactions to conservation treatments. A close examination of many woodlands reveals differences in site qualities that may be attributed to differences in the environment under which the trees are growing. The environment of an area for tree growth is the combined factors of soil, climate, landscape and biological activity. Research and experience have shown that no one of the many physical, chemical or biological factors of the environment alone determines the yield or management of a woodcrop, or of a cultivated crop. The particular combination of these properties must be considered in effectively producing and managing crops. Within any more-or-less homogeneous climatic area, such as southwest Washington, where management and biological activity may be viewed under similar circumstances, differences in soil for producing and managing crops can be studied. It is the purpose of this progress report to bring together available knowledge about soils on the area and to present the information in such a way that woodland owners may use it in their woodland conservation operations.

Woodcrops are an important segment of the Western Washington economy. Most of the virgin timber has been removed. Part of the lands have been reforested by nature, or by planting; other lands are in cultivation and pasture. In recent years the demand has increased to evaluate the different kinds of soil for woodcrop, agricultural and other uses. There is an immediate need for information about potential soil productivity for woodcrops. Tree site index, the accepted indicator of potential soil productivity for woodcrops, cannot be measured on recently cutover land or on agricultural cropland. It can be determined from some of the forest stands found today on many of the important soils of the area and the information used for these same soils wherever else they may occur. A framework of such information on important soils forms a basis for projecting usable productivity information to many other soils with similar physical and chemical characteristics.

Soils maps made in connection with the National Cooperative Soil Survey, show delineated segments of the landscape within which tree growth responses and treatment requirements for the production of woodcrops are essentially similar. Soil interpretation for different uses, such as woodland or cultivated crops, applying to these delineated, more-or-less homogeneous mapping units, provides information that is useful in land-management planning. Such soils maps and woodland interpretations are used in the Soil Conservation Service as a basis for developing technical guides to assist woodland owners and operators in woodland management.

Information is presented in this report by groups of soils that have similar woodland suitability. They are called Woodland Suitability Groupings of soils and they are discussed more completely later. The Douglas fir woodcrop is considered mainly, but some information is also supplied for western hemlock, red alder, and for certain minor forest

understory products. It is recognized that some of the interpretations are tentative and may be changed as more knowledge becomes available. The interpretations presented herewith are based upon the best information currently available from research and upon the experienced judgment of many soil scientists, foresters, woodland owners and operators who have first-hand knowledge of this area.

INFORMATION ABOUT THE AREA

The Southwest Washington area (Figure 1) comprises about 4.8 million acres of which 856,000 acres (about 18%) are in farms. About 8½% or 406,000 acres of the total area are woodlands. The remainder of the area is in small urban, large corporate, federal, state, and county ownerships (Table 1). The Southwest Washington area is bounded on the south by the Columbia River, on the west by the Pacific Ocean, on the east by the Cascade Mountains, and on the north by the southern limits of the Wisconsin Age Vashon glaciation, in Thurston and Mason Counties.

Topography varies from nearly level to very steep. The flatter areas occupy stream bottomlands, terrace and upland basins. The topography of the high terraces is commonly gently rolling to rolling, and in places adjacent to drainage ways, is steep. Topography of the uplands is most commonly rolling to very steep.

Settlement of the area began about 1825 near Vancouver, then a trading post of the Hudson Bay Company. Settlements were largely confined to the river valleys and prairie uplands of the area (7).1/ A dense growth of Douglas fir, western hemlock, and western red cedar originally covered the area, an important factor which led to the development of a vast lumber industry. Nearly all of the virgin forests have been removed, as second and third growth forests assume greater importance to the lumber industry. Many farmer, lumber and pulp operators are presently operating on a sustained yield basis.

In the early part of the century, farmers were primarily interested in removing trees to prepare the land for growing food crops. With a changing agriculture and with the agricultural economy depending upon production efficiency, many farmers have come to recognize that, on some soils, tree farming can be as profitable an enterprise as food production. Success or failure of a wood production enterprise depends partly upon selecting suitable soils for this use. An increasing interest in woodcrop production is borne out by planting and management statistics.

1/ Figures in parentheses refer to literature cited.

Figure 1. Southwest Washington Area.

Table 1. Area in farms and woodlands in Southwest Washington (1955 Census figures).

	Total Acres	Land in Farms		Woodland in Farms	
		Acres	Percent of Total Area	Acres	Percent of Total Area
State	42,743,040	17,641,429	41.3	3,709,784	8.67
(Southwest Washington Area)	4,802,470	856,641	17.84	406,886	8.47
Clark County	405,120	208,414	51.4	77,637	19.16
Cowlitz County	733,440	101,707	13.9	58,011	7.91
Grays Harbor County	1,219,200	118,217	9.7	55,195	5.53
Lewis County	1,566,080	292,394	18.7	152,921	9.76
Pacific County	592,000	63,374	10.7	30,000	5.07
Thurston County (25%)	114,470	39,300	34.3	21,500	18.78
Wahkiakum County	172,160	33,235	19.3	11,622	6.75

The parent rock materials from which soils of the area were formed are representative of the Eocene, Miocene, Pleistocene and Present Epochs (13). Rocks of the Eocene Epoch consist of porphyritic basalt, porphyritic andesite, olivene basalt, conglomerate, sandstone and siltstone. The Miocene Epoch rocks consist of volcanic breccias and tuffs, porphyritic andesite, siltstone, sandstone and conglomerate. Most of the siltstone, sandstone and conglomerate of this epoch consist of material derived from explosive volcanos and from erosion of volcanic flows. Deposits of the Pleistocene Epoch consist of fluvial and glaciofluvial deposits on high terraces. Many gravels of this deposit are deeply weathered andesite and basalt. During the late Pleistocene, large volumes of water caused high terraces to be formed. The gravels of these terraces lack the deep weathering of the early Pleistocene. Fossils of the Mammoth have been uncovered in these late Pleistocene deposits. Recent geological materials of various kinds occur on low terraces and stream bottomlands, and as volcanic ash and pumice on uplands and high terraces.

Soil is produced by certain soil-forming processes acting upon materials deposited or accumulated through geologic time. The characteristics of a soil at any particular place are determined by (a) physical and mineralogical composition of the parent material; (b) climate under which the soil material has accumulated and the soil developed; (c) relief or "lay of the land", which influences drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and the elements; (d) biological forces acting upon the soil material, such as plants and animals living in and on the soil; and (e) length of time the climate and biological forces have acted upon the soil material.

Wide ranges of environmental characteristics and of parent materials have created a large number of soils in Southwest Washington in a complex association pattern, particularly on high terraces. In this work 296 soil types and phases were studied to determine their significant properties. These soils are classified among twelve Great Soil Groups (15). The most important woodland soils of the area are classified as Podzol, Brown Podzolic, Reddish Brown Lateritic, Yellowish Brown Lateritic, Regosol and Alluvial. Soils of the Gray Brown Podzolic, Sol Lessive, Planosol, Low Humic Gley, Humic Gley and Ando Great Soil Groups are of lesser extent.

Detailed descriptions of soils studied may be found in the Lewis (2), Mason (10), and Thurston (11) County Soil Survey reports. These reports also contain detailed soil maps showing the location of each different kind of soil. Properties which characterize each of the Great Soil Groups listed above may be found in the U. S. Department of Agriculture Yearbook, Soils and Men (20), and in a paper by Thorp and Smith (15).

Hansen (4) reports, in Climate and Chronology in the Pacific Northwest, that pollen studies in peat bogs indicated the climate of this area to have progressed through marked changes during the period following the Late Wisconsin Glacial Epoch. The first period, between 10,000 and 12,000 years ago (dates adjusted to C-14 datings by Rigg), was cool and moist, and lodgepole pine predominated in the forest vegetation. With increasing warmth and dryness during the second period (between 6,500 and 10,000 years ago) lodgepole pine, fir, and spruce declined and Douglas fir expanded rapidly. The third climatic phase (between 3,500 and 6,500 years ago) was characterized by a warmer and drier climate than at present. This retarded the expansion of Douglas fir and the vegetative cover was dominated by oak. During the last 3,500 years the climate has become cooler and more moist, oak vegetation has declined, Douglas fir has reached its maximum development, and western hemlock has remained static or showed a slight increase. The present stands of Oregon white oak are presumed to be relic stands which have survived from the drier era.

The climate [1/] of southwestern Washington is primarily a mid-latitude, west coast, marine-type with cool dry summers, mild but rather rainy winters, with moist air and a small range in temperature (Table 2). Some of the factors influencing the climate are rugged terrain, prevailing westerly winds, distances and direction from the ocean. A circulation of air around the large high pressure area covering the north Pacific during the late spring and summer brings a prevailing flow of cool and comparatively dry air into this area. This results in a dry season beginning in the late spring and reaching a peak in midsummer. During the summer and early fall, fog or low clouds with tops 1,000 to 2,000 feet above sea level frequently form at night and disappear by the following noon.

1/ This information is furnished through the courtesy of Earl L. Phillips, State Climatologist, U.S. Weather Bureau, Seattle, Washington.

Table 2. Average Maximum and Minimum Temperatures (Degrees Fahrenheit) During Spring, Summer, Fall and Winter for Stations in Southwest Washington.

Station	County	Elevation (ft.)	SPRING (Mar,Apr,May)		SUMMER (Jun,Jul,Aug)		FALL (Sep,Oct,Nov)		WINTER (Dec,Jan,Feb)	
			Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Kosmos	Lewis	775	60	37	76	47	62	39	45	30
Longview	Cowlitz	12	61	39	76	50	63	43	47	33
Oakville	Grays Harbor	130	60	38	75	49	62	42	47	33
Spirit Lake	Skamania	3240	46	29	67	42	52	36	35	26
Willapa Harbor	Pacific	150	58	40	70	51	62	44	49	35
Wind River	Skamania	1147	59	34	77	45	61	37	41	27

Maximum temperatures in the warmest months occur in the 70's, and occasionally reach 80° to 90°. The hottest weather occurs when dry easterly winds reach this area. Humidity is low under these conditions and the danger of forest fires is high. Following one or two days of unusually warm, dry weather, cooler moist air from the ocean usually moves inland. The average relative humidity in the warmest and driest months ranges from 50% in mid-afternoon to 85% at sunrise.

A prevailing southwesterly flow of warm moist air during the fall and winter results in a rainy season beginning in October and reaching a peak in mid-winter (Table 3). The annual precipitation in the lower elevations along the coast approximates 65 to 80 inches, increasing along the windward slopes of the Willapa Hills and other coastal ridges (Figure 2). An increase of a few hundred feet in elevation is sufficient to cause a significant increase in precipitation. Precipitation decreases along the lee slopes of these ridges and the annual amount varies from 40 to 60 inches in the lower elevations between the Coastal and Cascade Mountain ranges. There is an increase in precipitation along the western slope of the Cascades. Rainfall amounts varying from 3 to 6 inches in 24 hours have been recorded in the heavier precipitation areas. Probabilities of occurrence of maximum and minimum annual precipitation are shown for Southwest Washington Stations in Table 4.

Winter precipitation generally occurs as rain below elevations of 1,000 feet, but may be either rain or snow at elevations to 3,000 feet and is predominately snow in the higher elevations. A few rather intense winter storms move inland in this area almost every year. Wind velocities, ranging from 50 to 70 m.p.h., occur in the lower elevations along the coast, and velocities in excess of 100 m.p.h. have been reported at exposed locations on the higher ridges.

Winter temperatures are very mild for this latitude and long growing seasons prevail for a large part of the area (Table 5 and Figures 3 and 4). Maximum winter temperatures are in the 40's (degrees Fahrenheit) and minimum readings are in the mid-30's. Minimum temperatures drop below freezing on 30 to 60 nights during most winters. The daily range in temperature is very small during the cloudy and rainy winter season. The coldest weather occurs when cold dry air from Canada or from east of the Cascades occasionally reach this area. Clear skies generally prevail under these conditions and minimum temperatures range from 10° to 15°, and maximum readings fail to rise above freezing for a few days.

Techniques developed by Palmer-Havens for application of the Thornthwaite method (1948) were used to estimate the potential evapotranspiration or the amount of moisture, which, if available, could be used by plants. The potential evapotranspiration computed from temperature and precipitation records (period 1931-52) for stations in this area of the State is listed in Table 6. The average precipitation, in inches, for each month is given on the first line and the computed potential evapotranspiration (PET), in inches, is given on the second line of data for each station.

Table 3. Average Monthly Precipitation Data for Southwest Washington (Precipitation in Inches).

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Ariel Dam	9.4	8.4	7.6	4.4	3.1	2.8	0.9	1.4	2.9	6.9	10.3	11.8	69.9
Battle Ground	6.9	5.2	5.2	3.4	3.0	2.5	0.6	0.9	2.2	5.0	7.2	7.8	49.9
Brooklyn	11.1	9.5	8.6	5.1	3.2	2.5	0.9	1.4	3.1	7.9	10.2	13.3	76.8
Kalama	9.1	7.0	7.6	4.4	3.3	2.7	0.9	1.5	2.5	5.9	8.6	10.5	64.0
Kid Valley	7.3	6.3	6.4	4.7	3.5	3.1	1.1	1.8	2.6	5.8	8.0	8.7	59.3
Mineral	13.2	11.7	9.5	6.0	4.0	3.6	1.1	1.4	3.1	7.8	12.8	14.4	88.6
Naselle	17.1	14.3	13.6	7.1	4.3	3.6	1.6	2.0	4.6	11.1	15.0	20.1	114.4
Peterson's Ranch	17.9	14.8	13.8	7.4	4.7	4.1	1.4	1.5	4.1	11.2	17.3	21.8	120.0
Rainbow Falls	7.6	7.0	5.6	3.7	2.2	1.9	0.6	1.0	2.1	5.0	7.5	8.2	52.4
Spirit Lake	13.8	10.6	10.8	6.0	4.7	3.7	1.0	2.0	3.9	8.7	13.0	15.6	93.8
Washougal	10.6	7.9	8.3	5.4	4.3	3.7	0.9	1.6	3.1	7.1	9.9	12.0	74.8
Yacolt	10.1	8.4	9.3	4.6	3.7	2.9	1.0	1.3	2.9	6.9	10.6	13.5	75.2

Table 4. Average and Probabilities of Occurrence of Minimum and Maximum Annual Precipitation for Stations in Southwest Washington (Precipitation in Inches).

Station	County	Elevation (ft.)	Period of Record	Average Annual	1 Yr. in 10 will have: Less Than	1 Yr. in 10 will have: More Than	2 Yrs. in 10 will have: Less Than	2 Yrs. in 10 will have: More Than	3 Yrs. in 10 will have: Less Than	3 Yrs. in 10 will have: More Than	4 Yrs. in 10 will have: Less Than	4 Yrs. in 10 will have: More Than
Aberdeen	Grays Harbor	12	1931-60	85	70	103	71	97	77	91	79	89
Ariel Dam	Cowlitz	48	1936-60	70	52	83	55	82	63	80	65	76
Battle Ground	Clark	295	1941-60	50	36	61	45	58	48	55	50	53
Brooklyn	Pacific	190	1931-60	77	57	95	62	90	70	86	72	85
Centralia	Lewis	185	1931-60	46	34	57	37	55	41	51	45	49
Kalama	Cowlitz	900	1918-60	64	47	78	53	76	60	68	61	64
Kid Valley	Cowlitz	690	1941-60	59	41	72	48	72	53	64	54	62
Kosmos	Lewis	775	1933-60	62	41	79	49	74	51	69	56	67
Longview	Cowlitz	12	1931-60	45	30	58	36	55	41	51	43	47
Mineral	Lewis	1500	1934-60	87	64	105	70	101	81	96	90	92
Naselle	Pacific	26	1931-60	114	92	142	96	128	104	127	119	122
Oakville	Grays Harbor	130	1931-60	55	42	65	47	60	50	59	53	56
Peterson Ranch	Cowlitz	596	1931-54	120	80	144	100	142	104	137	112	128
Rainbow Falls Pk.	Lewis	280	1936-60	52	37	62	44	61	46	58	49	57
Spirit Lake	Skamania	3240	1932-56	94	71	117	72	113	73	103	82	91
Vancouver	Clark	100	1931-60	39	27	49	31	45	35	42	38	41
Washougal	Skamania	760	1933-60	75	48	90	60	86	64	84	67	79
Willapa Harbor	Pacific	150	1931-60	87	65	109	69	100	73	97	84	93
Wind River	Skamania	1145	1931-60	100	72	136	78	116	88	113	96	103
Yacolt	Clark	737	1912-46	75	52	92	62	89	71	88	76	82

Figure 2. Mean Annual Precipitation, Southwest Washington Area.

Table 5. Average length of the growing season in days (Average number of days between last occurrence and first occurrence in the fall of specified minimum temperatures)

Station	County	Elevation (ft.)	Average length of growing season limited by minimum temperatures of: 32°F. (days)	28°F. (days)	24°F. (days)
Aberdeen	Grays Harbor	12	189	251	327
Battle Ground	Clark	295	158	217	274
Centralia	Lewis	185	178	233	294
Kid Valley	Cowlitz	690	171	223	274
Kosmos	Lewis	775	142	202	249
Longview	Cowlitz	12	172	222	292
Oakville	Grays Harbor	130	154	218	277
Olympia Airport	Thurston	190	160	210	266
Olympia Priest Pt. Park	Thurston	27	196	258	320
Rainier Longmire	Pierce	2762	129	182	226
Vancouver	Clark	100	235	293	334
Willapa Harbor	Pacific	150	209	271	335
Wind River	Skamania	1145	135	173	237

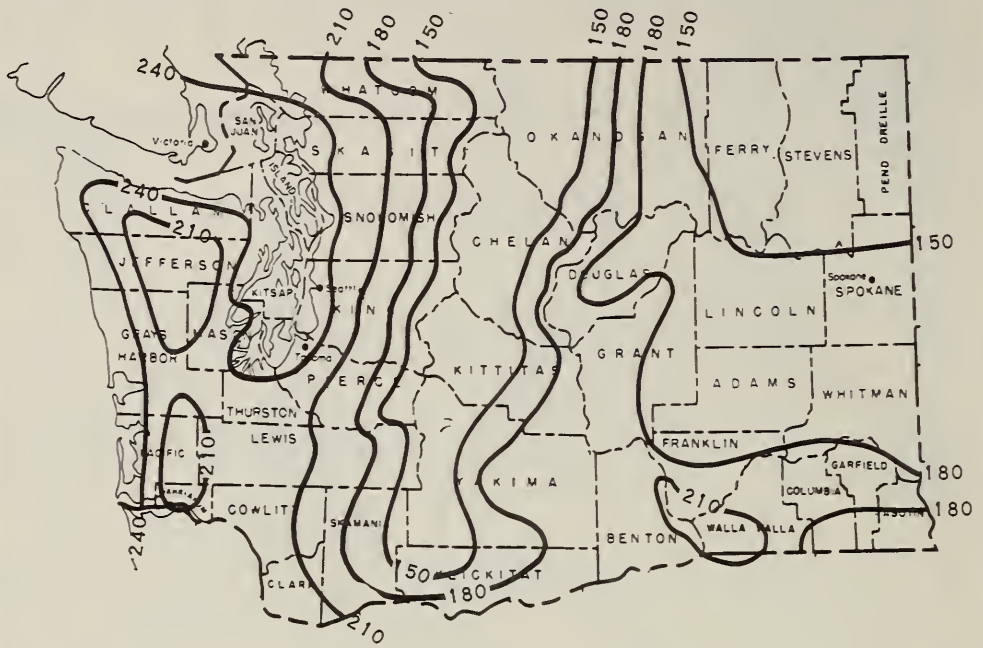

Figure 3. Mean Length of Growing Season, days (28°F), State of Washington.

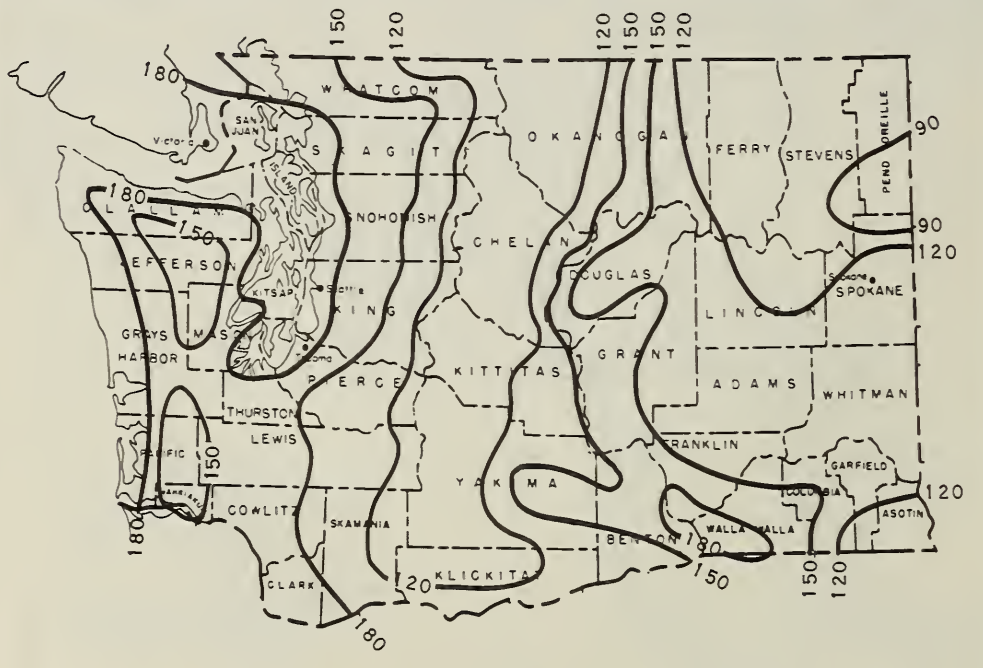

Figure 4. Mean Length Of Growing Season, days (32°F), State of Washington.

Source: Washington State Freeze Circular. Stations Circular 400. Washington Agricultural Experiment Stations, Institute of Agricultural Sciences, Washington State University.

Table 6. Average monthly precipitation and estimated potential evapotranspiration for stations in Southwest Washington (values are presented in inches).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ABERDEEN												
Precip.	12.8	10.4	8.9	5.5	3.4	2.6	1.6	1.8	3.6	8.1	11.1	15.0
PET 1/	.6	.7	1.2	1.9	2.8	3.5	4.0	3.7	2.9	2.0	1.0	.7
CENTRALIA												
Precip.	6.3	5.6	4.5	2.6	1.9	1.8	.8	1.0	1.9	4.5	6.5	8.0
PET	.4	.6	1.2	1.9	3.1	3.8	4.5	4.1	3.1	1.8	.9	.6
KOSMOS												
Precip.	7.7	6.6	6.0	3.9	2.9	2.9	1.0	1.3	2.9	6.0	8.4	10.5
PET	.2	.4	1.0	1.9	2.9	3.7	4.5	3.9	2.9	1.8	.7	.4
LONGVIEW												
Precip.	5.8	5.0	4.8	2.6	2.2	2.1	.8	1.2	2.0	4.5	6.3	7.8
PET	.4	.6	1.2	1.9	2.9	3.7	4.4	4.1	3.1	1.9	1.3	.5
OAKVILLE												
Precip.	8.5	6.7	5.5	3.3	2.3	1.7	.7	1.0	2.3	5.4	7.9	9.9
PET	.4	.6	1.1	1.9	3.0	3.7	4.4	4.0	3.0	1.8	.9	.6
RAINIER LONGMIRE												
Precip.	11.0	9.0	8.2	4.9	4.1	3.6	1.5	1.6	3.6	8.4	11.5	14.0
PET		.1	.9	1.3	2.6	3.4	4.4	4.0	2.9	1.8	.6	.1
VANCOUVER												
Precip.	5.4	4.4	3.9	2.3	1.9	1.8	.5	.7	1.7	3.6	5.8	7.1
PET	.4	.6	1.2	2.1	3.3	3.9	4.8	4.4	3.3	2.0	.9	.5
WILLAPA HARBOR												
Precip.	12.3	10.5	9.6	5.8	3.7	3.1	1.6	1.7	3.4	8.2	11.1	15.0
PET	.6	.8	1.2	1.8	2.8	3.5	4.1	3.7	2.9	2.1	1.1	.7
WIND RIVER												
Precip.	16.1	12.4	11.2	6.1	3.8	2.5	1.2	1.0	3.0	8.8	14.6	19.1
PET		.3	.9	1.8	2.9	3.7	4.4	4.0	3.0	1.8	.6	.2

The average evaporation in inches of water from a Weather Bureau Class A evaporation pan installed at the Wind River Experimental Forest Station (1923-1956) is as follows:

Month	Apr	May	Jun	Jul	Aug	Sep	Oct
Evaporation	3.2	4.7	5.2	6.9	5.7	3.6	1.6

1/ PET represents potential evapotranspiration.

PREVIOUS RELATED WORK

Hill, Arnst, and Bond (5) conducted studies in Lewis County in 1944 to determine the correlation between Douglas fir site quality and soils. They found that soils having certain properties in common, under comparable conditions, have a similar potential for growing Douglas fir. Slope gradient of the land did not affect the woodland site index. They found the site index in Grays Harbor County was about 30 points higher than for comparable soils elsewhere and attributed it to much higher rainfall (60-100 inches in Grays Harbor County as against 45-55 inches in Western Lewis County). They concluded that site quality for Douglas fir appears to be governed by moisture relationships of the soil.

Gessel and Lloyd (3) conducted a soil-woodland site survey in Northwest Washington in 1949. They found that woodland site quality increased as soil textures changed from coarse to moderately-coarse and medium. Medium textured soils did not differ significantly among themselves in site index.

Carmean (1) determined that Douglas fir site quality decreased with an increase in elevation, with an increase in the gravel content of the soil, and with increased compaction of the soil layers above the substratum. He found, also, that site quality increased with an increase in total precipitation and with an increase in depth to the substratum.

Lemmon (6) studied the influences on average tree height growth of several factors (average tree age, total soil depth, aspect, slope percentage, elevation, average annual and average growing season precipitation) and found that total effective soil depth was most important in affecting site index for Douglas fir. He indicated that total effective soil depth gains its importance through the internal water relationships of the soil profile as it influences plant growth. Further, he indicated that slope and aspect are more important for indicating hazards and limitations in forest use, rather than as factors to reflect differences in forest productivity in the area of study.

Schlots, Deardorff, and Lloyd (14) found that site quality for Douglas fir was lower on soils with fine textured B horizons than on those with medium textured B horizons. It was noted that feeder roots completely penetrated the soil peds of the medium textures, whereas they were concentrated on the ped surfaces of the moderately fine and fine textured B horizons.

Detailed soil surveys (2, 10, 11) for Lewis, Mason and Thurston Counties, and soil surveys in progress for the remainder of the area were used freely as references while developing the information in this progress report.

COLLECTION OF INFORMATION

Soil Conservation Service studies of soil-Douglas fir growth relationships began in Western Washington in 1944. Later they were extended to include western hemlock and red alder. Soil scientists and foresters worked together to locate suitable forest stands found growing on uniform, representative soils. They made measurements and observations and systematically recorded both soil and woodland information. Observations and measurements were made in 457 stands of Douglas fir and 25 stands of western hemlock. In all, 59 soil series representing 78 soil types were sampled. The measured sites occurred at elevations ranging from near sea level up to 2100 feet. Distribution of plots by elevation classes are:

Less than 200 feet elevation	22 percent
200 to 500 feet elevation	55 percent
500 to 1000 feet elevation	16 percent
1000 to 1500 feet elevation	4 percent
1500 to 2100 feet elevation	3 percent

Site locations were posted on county and area maps for permanent record (figure 5). Copies of data sheets showing plot locations to the nearest 40 acres are on file in the Soil Conservation Service State Office at Spokane, Washington.

Soils were examined by spade and auger borings in the area of sampling and then described in detail from pits dug near the center of each measured forest stand. Each significant soil layer or horizon was examined and the data recorded and classified according to standard soil survey procedures (16, 17, 18, 19). The amount of gravel in gravelly soils, was determined volumetrically in the field by measuring the amount of soil passing through a 2 mm. screen. Information pertaining to physiographic land features and climate was recorded for each site. Annual precipitation and length of growing season were estimated for each plot by reference to isoline maps (figures 2, 3, and 4), and from other climatological data supplied by the U.S. Weather Bureau. Length of growing season (column 7, Appendix tables 1, 2, and 3) is the average number of days with temperature above the 28° F. level. Interpolations for precipitation and climate were made for each plot on the basis of elevation and aspect with the assistance of U.S. Weather Bureau personnel.

Soils to be examined were selected at random in the early stages of the study. The principal requisite was that study sites have acceptable trees for measurement and that the soil resemble closely the central concept of the particular named soil being studied. Later in the study, as data accumulated, an attempt was made to select study sites on the basis of balance, and soils considered to have sufficient data were by-passed.

Tree growth measurements were made on a maximum five trees per sample site. Information recorded included species, crown class, diameter at breast height, number of annual rings at breast height (taken with tree increment borer) and total height (taken with Abney level at a measured distance from the tree).

The annual ring count for each tree was converted to total age by adding a correction factor that makes allowance for the time required for the young tree to grow to breast height. Average site index for each sample was determined before leaving the area. Site index classifications used were: for Douglas fir, McArdle, Meyer, and Bruce, 1949, Rev. (8); for western hemlock, Meyer, 1937 (22) and for red alder, Worthington, Johnson, Staebler, and Lloyd, 1960 (23).

Trees measured in the study had to be healthy, free growing dominant or co-dominant components of fully-stocked even-aged stands, preferably no younger than 30 years, and under 100 years of age (between 30 to 60 years in the case of red alder). Other environmental information such as forest type, land form, slope gradient, and aspect, approximate slope length and shape, position on slope, understory composition and density, overstory composition, density of crown canopy, and stem basal area per acre was observed and recorded. Data from each site studied are reproduced in appendix tables 1, 2, and 3.

PROCESSING AND ANALYZING THE INFORMATION

Soil mapping units (phases of soil types) that delineate more-or-less uniform segments of the landscape provide a practical basis for relating potential tree growth, management and treatment needs to different kinds of soil. The basic information for this report was obtained from specific soil taxonomic units. For practical reasons it is used to interpret soil mapping units. A soil mapping unit may be composed of a single soil taxonomic unit that gives it its name, but it may also be defined in terms of external features, such as physiographic phases, or soil features such as slope and erosion. In addition it may include up to 15 percent of unrelated soil individuals. The phase of a soil type used in standard soil surveys is the mapping unit about which the greatest number of precise statements and predictions can be made concerning soil use, productivity, and management. Interpretations presented in this report are summarized by individual soil mapping units that have been used in soil surveys of southwest Washington.

Each of the 296 soil mapping units used in soil surveys of the area were "rated" for certain capabilities, hazards and limitations known to be important in woodland uses. These rated items, applying primarily to the Douglas fir woodcrop, are: potential soil productivity (site index); species suitability, plant competition (brush encroachment); potential for producing certain minor forest understory products; windthrow hazard; erosion hazard; equipment limitations (trafficability); and Christmas tree potential. These are discussed in the section following.

It was not possible to sample every soil mapping unit for evaluation of woodcrop suitabilities. To supply an evaluation for soils which lacked woodcrop suitability information, those soils were assembled with others that were similar in selected physical properties and conditions. Known information within these groups was then supplied to all soils within each group.

Figure 5. Location of Soil-Site Index Increments, Southwest Washington Area.

Each of the soil capabilities, hazards and limitations which enter into the ratings are discussed as follows:

Potential Soil Productivity. This refers to the potential capacity of a soil to produce wood volume. It is indicated by site index, the average total height of dominant and co-dominant Douglas fir and western hemlock trees at 100 years of age (50 years of age for red alder). Measurement information presented in this report is mostly for Douglas fir. Some site index information for western hemlock is presented and interpreted but much more information is needed in order to provide satisfactory interpretations. Preliminary information is also available for red alder on a few soils but currently this is fragmentary and no attempt has been made to furnish usable average site index information for this species (Appendix table 3).

Site index ratings may be interpreted into quantitative terms of growth and yield based on published research (Appendix Figures 1 and 2). These interpretations have been made for each group of soils which are discussed later in this report. Potential soil productivity for Douglas fir and western hemlock is presented in three ways: (1) by average site index for specific soil taxonomic units, for soil mapping units, and for groups of soil mapping units; (2) by verbal ratings of site quality, such as excellent, very good, good, fair, and poor and (3) by indicating the approximate average annual board and cubic feet growth per acre from well-stocked, even-aged, unmanaged stands at a rotation age that would be practicable for medium sites. Equivalent values for verbal and site index ratings are as follows:

	Site Index Range by Woodcrops		
Verbal Ratings	Douglas Fir	Western Hemlock	Red Alder
Excellent	185 and over	190 and over	105 and over
Very good	155 to 184	150 to 189	95 to 104
Good	125 to 154	110 to 149	85 to 94
Fair	95 to 124	70 to 109	75 to 84
Poor	94 and below	69 and below	74 and below

Table 7 is a summary of site index measurements for Douglas fir and western hemlock for soil mapping units in southwest Washington. Individual site index measurements are summarized for these two species and for red alder in Appendix tables 1, 2, and 3. In total, 516 forest stands were measured. This included 457 usable sites of Douglas fir, 25 usable sites of western hemlock and 5 usable sites of red alder. Twenty-nine sites, not shown in the Appendix tables, were rejected because their average site index departed from the mean by three standard deviations or more and the field notes indicated that certain disqualifying circumstances such as past cutting, fire disturbance, etc., were suspected of having affected the true potential height growth of the stands.

Table 7. Average Site Indexes For Douglas Fir and Western Hemlock by Soil Mapping Units in Southwest Washington.

Soil Mapping Units			Average Site Index 2/	
SOIL TYPE	SLOPE CLASS 1/	WOODLAND SUITABILITY GROUP	DOUGLAS FIR	WESTERN HEMLOCK
Astoria silty clay loam	A,B,C,D,E	1	182 ± 11 (36)	170 ± 11 (13)
Bear Prairie silt loam	A,B,C,D,E	9	141 ± 7 (5)	
Belle silt loam	A,B,C,D,E	1	196 (1)	
Brenner silt loam	A	5		200 (1)
Chehalis silty clay loam	A	5	174 (2)	
Chemawa shotty loam	B,C,D,E	12	155 ± 5 (5)	
Cinebar silt loam	A,B,C,D, E,F	4	179 ± 9 (21)	
Cinebar stony silt loam	A,B,C,D, E,F	4	179 ± 11 (9)	
Cloquallum silt loam, nearly level	A,B	10	123 (1)	
Clove silt loam	A,B,C,D	7	164 ± 5 (12)	
Copalis gravelly silt loam	A,B,C,D	2		161 (1)
Delp loam	A,B,C,D,E	12	155 ± 9 (10)	
Dobler silt loam	A,B,C,D,E	6	169 ± 5 (7)	
Dollar loam	A,B	12	152 ± 10 (6)	
Felida silt loam	A,B,C,D, E,F	12	158 ± 4 (7)	
Gee silt loam	A,B,C,D, E,F	12	154 ± 7 (13)	
Germany silt loam	A,B,C,D	1	191 ± 10 (10)	
Haapa silt loam	A,B,C,D,E	6	163 ± 4 (7)	
Hesson clay loam	A,B,C,D,E	12	153 ± 3 (7)	
Hidden loam	A,B,C	11	137 (1)	
Hoquiam silt loam	A,B,C,D	1		177 ± 9 (5)
Kelso silt loam	A,B,C,D	4	178 ± 6 (3)	

1/ Slope classes are A, 0-3%; B, 3-8%; C, 8-15%; D, 15-30%; E, over 30%.

2/ Average site index value = height in feet at 100 years ± the standard deviation; figures in parenthesis represent no. of sample plots.

Table 7 (Continued)

SOIL TYPE	SLOPE CLASS 1/	WOODLAND SUITABILITY GROUP	DOUGLAS FIR	WESTERN HEMLOCK
Kinney cobbly silt loam	D,E,F	8	138 (1)	
Klaber silty clay loam	A,B	7	158 ± 5 (5)	
Knappa silt loam (High rainfall phase)	A,B,C,D	1	191 ± 8 (6)	186 ± 9 (5)
Knappa silt loam (Medium rainfall phase)	A,B,C,D	6	168 ± 6 (7)	
Lacamas silty clay loam	A	18	124 (2)	
Lauren gravelly loam	A,B,C,D,E	11	120 ± 4 (6)	
Lauren loam, deep	A,B,C,D	11	140 ± 8 (9)	
Malone gravelly loam	A,B	9	143 (1)	
Martha clay loam	A	18	129 (2)	
Melbourne silty clay loam	A,B,C,D,E	13	158 ± 10 (38)	
Meskill silty clay loam	A,B,C	7	144 ± 5 (7)	
Odne silt loam	A	18	122 (1)	
Olequa silt loam	A,B,C	6	160 ± 7 (4)	
Olympic clay loam, deep	A,B,C,D	4	171 ± 3 (11)	
Olympic clay loam, and silty clay loam	A,B,C,D, E,F	13	156 ± 7 (37)	
Olympic stony clay loam	A,B,C	8	143 ± 3 (6)	
Onalaska silt loam	A,B	7	167 ± 18 (7)	
Parkdale silt loam	A,B	12	146 ± 3 (3)	
Prindle sandy loam	A,B,C,D, E,F	17	94 (2)	
Puyallup silt loam	A	3	186 (2)	
Riffe sandy loam	A,B	14	154 (1)	
Roper gravelly loam	A,B,C,D, E,F	11	141 ± 6 (6)	
St. Martins clay loam	A,B,C,D,E	16	105 (1)	
Salkum silty clay loam and clay loam	A,B,C	12	156 ± 6 (37)	

Table 7 (Continued)

SOIL TYPE	SLOPE CLASS 1/	WOODLAND SUITABILITY GROUP	DOUGLAS FIR	WESTERN HEMLOCK
Salkum silty clay loam and clay loam, deep	A,B,C	4	177 ± 7	(9)
Salkum silty clay loam and clay loam, shallow	A,B,C	10	137 ± 6	(11)
Sara silt loam	A,B,C,D	10	128	(2)
Scammon silt loam	A,B,C	7	167 ± 6	(5)
Scammon silt loam, deep	A,B,C	7	170	(1)
Scammon silty clay loam	A,B,C	7	146 ± 6	(6)
Seaquest clay loam	A,B,C,D	4	172 ± 3	(5)
Skamokawa silt loam	A,B	6	164	(2)
Stabler shotty loam	A,B	15	104	(2)
Stabler silt loam	A,B	15	122	(1)
Stevenson clay loam	A,B,C,D	8	139	(3)
Stevenson gravelly silt loam	A,B,C,D, E,F	8	135	(1)
Stevenson stony loam	A,B,C,D, E,F	8	137	(2)
Tebo loam	A,B,C,D,E	1	180	(1)
Tebo clay loam	A,B,C,D,E	1	168	(1)
Toutle loamy sand	A,B	14	151 ± 7	(11)
Vader loam	B,C,D,E,F	1	185	(2)
Viola clay loam	A,B,C,D,E	7	149 ± 3	(6)
Wadell stony silty clay loam		4	172 ± 8	(2)
Wapato silty clay loam		18	125	(1)
Wind River gravelly loam	A,B	11	133	(1)
Wind River silt loam	A,B,C,D	14	150	(1)
Winlock silty clay loam	A,B,C	4	173	(2)
Winston gravelly loam	A,B	11	158 ± 7	(7)
Winston gravelly sandy loam	A,B,C,D	11	135 ± 8	(3)
Yacolt silt loam	A,B,C,D	12	154 ± 6	(4)

Species Suitability. The general adaptation range of commercially important species was considered in designating suitable species for the different soils. Species suitability is not shown in the suitability table (Table 8), but is presented in the narrative description for each Woodland Suitability Group of soils.

Usually several different commercial species will grow on a particular soil. Each species may not grow at the same rate, or the relative technical quality and the market demand among species may favor one over the others. The relative difficulty of establishing reproduction of each species in certain situations may be a factor. These are the principal items considered in making ratings of soils for species suitability. The ratings herein are not based on intensive research studies, but represent the observations and opinions of local foresters, soil scientists, woodland owners and others who have observed the local soils and related tree growth responses.

Plant Competition (Brush Encroachment). This refers to the degree of competition offered by, and the rate that, unwanted species invade different soils after openings are made in the canopy. This is significant to restocking of stands with Douglas fir. Rating are as follows:

1. Slight. No special problem is recognized. Invasion by undesirable species is not rapid enough to impede the development of a stand of Douglas fir.

2. Moderate. A moderate problem is recognized. Competition from such species as fern, salmonberry, vine maple, western hemlock, western red cedar, red alder and others develops soon after clear-cut logging or partial opening of the canopy. This may slow initial growth and delay development of the new Douglas fir stand, but will not prevent its eventual establishment. Some weeding operations may be desirable to hasten development of the desired stand.

3. Severe. A severe problem is recognized. Plant competition is immediate and severe following operations that provide canopy openings. Advance reproduction of shade-tolerant species such as western hemlock and western red cedar may have control of the growing site. Such plants as fern, sod grasses, foxglove, salmonberry, vine maple, or red alder reduce early survival of Douglas fir to less than adequate stocking. Continued competition results in a stand dominated by trees other than Douglas fir. Special treatments such as site preparation, hand or machine planting, subsequent weeding by chemical sprays or mechanical cultural treatments will usually be necessary to establish an adequate stocking and growth of Douglas fir.

Windthrow Hazard. This is an evaluation of soil characteristics that control root development affecting wind firmness of Douglas fir. Soils were rated according to the following classifications:

1. Slight. No special problem is recognized. Soils are deep and not subject to excessive wetness at any time of year. Root development is unimpeded and individual trees are expected to withstand average winds if released on two or more sides.

2. Moderate. A moderate windthrow hazard exists. A root-restricting layer may be present at a depth of 20" - 36" and excessive wetness may render trees unstable during occasionally heavy rainfall periods of brief duration. Thinnings of moderate intensity may be considered with only moderate losses expected from blowdown.

3. Severe. A severe problem is recognized. A root-restricting layer is usually present at depths of 20" or less and excessive wetness may occur each year and may extend over most of the winter rainy season to render trees unstable and subject to severe losses due to blowdown. Conventional thinning may prove hazardous to timber stands. Intermediate cuttings may need to be confined to salvage work and to conservative "thinnings from below."1/ Even so, important losses to forest stands may be expected from blowdown.

Erosion Hazard. This refers to the potential vulnerability of a soil to water erosion after its protective plant cover is disturbed. Ratings may lead to the development of special soil-saving techniques to be used in woodland management operations. Soils were rated as follows:

1. Slight. No special problems exist. Soils occur on level or gently sloping topography.

2. Moderate. A moderate problem exists, that may require modification of normal operating methods to prevent accelerated soil erosion. Soils occur on rolling to hilly topography (8% - 30%), and surface textures are usually moderately fine to medium.

3. Severe. A severe problem is recognized which will require considerable restriction in operating methods, and intensive use of preventive measures if serious erosion damage is to be avoided. Soils occur on steep to very steep topography and surface textures may be moderately coarse to very coarse.

Equipment Limitations (Trafficability). This is an evaluation of soil characteristics and physiography that restrict or prohibit the use of equipment normally used in woodland management operations. Knowledge of these factors may result in the adoption of alternate types of equipment, methods of operating, or in planned seasonal operation. Ratings were:

1. Slight. No special problem is recognized. Soils normally permit efficient use of conventional logging tractors and trucks during all seasons of the year without damage to the stand or site.

2. Moderate. A moderate problem is recognized. Soils may become saturated for short periods, cutailing skidding and hauling operations during portions of the winter rainy season. Injury to shallow root systems may require limited use of steel tread vehicles during thinning or partial cutting operations, especially when soils are wet. Slope

1/ Taking out smaller trees not a part of the dominant and co-dominant stand.

gradient will not prevent tractor skidding but complicates it somewhat and predisposes the soil to deterioration by erosion.

3. Severe. A severe problem is recognized. Soils remain saturated, or nearly so, during most of the winter rainy season. Tractor and truck traffic is thereby severely restricted. Shallow root systems may be injured severely by the indiscriminate use of steel tread equipment and site conditions may be impaired by compaction. Slopes may be too steep to permit tractor skidding and other methods of operation are often required.

Christmas Tree Potential. This refers to the relative suitability of a soil for producing Douglas fir Christmas trees of salable quality without cultural treatments. Ratings under this item tend to vary inversely with those for potential soil productivity for conventional woodcrops, as indicated by average site index. Soils were rated as follows:

1. High. Tree growth-rate is optimum to provide dense, compact, healthy Christmas trees of high quality, either as a major crop or supplementary to conventional woodcrop productions, without need for cultural measures.

2. Medium. Tree growth-rate is suitable to produce moderately dense and compact, healthy Christmas trees of medium quality but moderately intensive cultural treatments may be needed to improve the quality of the product and to overcome ill effects of competing brushy species.

3. Low. Tree growth-rate is too fast to produce marketable Christmas trees without excessive cultural treatment for "shaping" them. Excessive growth rates for Christmas trees may also be associated with the invasion and development of brushy species, that influence the production of high quality Christmas trees.

Minor Forest Products. This refers to the suitability of the soil, under natural forest conditions, to produce supplementary understory products that are salable. Supplementary products may be: floral greenery (salal, evergeeen huckleberry, fern, Oregon grape), cascara bark, etc. Soils were rated into the following classes:

1. High. Both quality and abundance of marketable forest understory products are usually high. Harvesting of economically operable quantity per acre may be done annually.

2. Medium. Quality and abundance of marketable forest understory products is usually only slightly above minimum standards to make their harvesting attractive. They are considered a marginal resource.

3. Low. Quality and abundance of marketable forest understory products is too low to make harvesting attractive. Such a resource is considered not important.

WOODLAND SUITABILITY GROUPINGS OF SOILS

Not all of the 296 soil mapping units occurring in southwest Washington are significantly different from each other in terms of capabilities, hazards and limitations in woodland uses. Soil groupings were therefore sought within which essentially similar potential for forest growth could be expected and for which similar woodland conservation treatment measures would potentially apply.

The soil ratings described in the preceeding section were used to assist in making the most practicable soil groupings. A 3 by 5 inch card was prepared for each soil mapping unit and the ratings coded and systematically recorded around the edge of the card by appropriate notching. The reverse side of each card was used similarly to code and record selected soil properties and conditions that, from published research, are known to be most important in tree growth and management. These cards were then sorted and resorted into groups based on the woodland items rated and on the basis of the selected physical soil characteristics to get the greatest uniformity among all rated items within each group. Twenty groups of soils were thus developed, by means of which essentially all available and important soil information useful in forest management is summarized for practical use.

These are called Woodland Suitability Groupings of Soils and they are shown with average ratings in Table 8. One group, No. 19, is subject to periodic overflow. Another group, No. 20, is poorly drained and used primarily for cultivated crops following the installation of adequate tile drainage systems. Neither of the two groups is considered to be potentially suited for Douglas fir or western hemlock.

It was found that physical soil characteristics and physiographic conditions, as well as forest growth potential and management requirements were related within these groups (Table 9). For practical purposes, information supplied for each group will apply to each soil mapping unit included. A few important discrepancies had to be allowed in order to reduce the number of groups to a practicable few. Knappa silt loam, for example, occurs in a 50 to 100 inch annual precipitation range, and the soil profile properties are similar throughout the area. The rate of growth was greater in the 70 to 100 inch precipitation zone than in the 50 to 70 inch zone. Knappa silt loam occurring in the 70 to 100 inch precipitation zone was tentatively phased as high rainfall and that in the 50 to 70 inch precipitation zone as medium rainfall. These discrepancies are explained in the discussions of each group which follows:

Table 8 - Woodland Suitability Groupings of Soils with Interpretations for Management and Treatment, Southwest Washington

Soil Group and Description 1/	Slope Classes 2/	Erosion Hazard	Equipment Limitations	Windthrow Hazard	Potential Soil Productivity Average Site Index 3/ Douglas Fir	Potential Soil Productivity Average Site Index 3/ Western Hemlock	Potential For Minor Understory Forest Products 4/	For Douglas Fir: Plant Competition	For Douglas Fir: Christmas Tree Potential
Group 1. Very deep and deep, well drained upland soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. Moderate to moderately slow permeability. Annual precipitation is 50 to 100 inches.	A and B	Slight	Slight to Moderate	Slight	185 ± 10 (57)	175 ± 10 (23)	High	Moderate to Severe	Low
	C and D	Slight to Moderate	Slight to Moderate	Slight					
	E and over	Severe	Severe	Slight					
Group 2. Moderately deep, well drained upland and high terrace soils with medium and moderately fine textured surfaces, moderately fine textured subsoils, and cemented gravel substrata. Modorate permeability. Annual precipitation is 90 to 100 inches.	A and B	Slight	Slight to Moderate	Moderate to Severe	--	161 (1)	High	Severe	Low
	C and D	Moderate	Moderate	Moderate to Severe					
Group 3. Deep, well drained and somewhat excessively drained bottomland soils with medium textured surfaces, and moderately coarse textured subsoils. Moderate to rapid permeability. Annual precipitation is 45 to 70 inches.	A and B	Slight	Slight to Modorate	Slight	186 (2)	--	Low	Moderate to Severe	Low
	C	Moderate	Modorate	Slight					
Group 4. Very deep, well drained and moderately well drained upland and high terrace soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. Moderate to moderately slow permeability. Annual precipitation is 45 to 70 inches.	A and B	Slight	Slight	Slight	176 ± 8 (62)	--	Moderate	Moderate to Severe	Low
	C and D	Moderate	Moderate	Slight					
	E and over	Severe	Sevore	Slight					
Group 5. Very deep, deep and moderately deep well drained, imperfectly and moderately well drained bottomland soils with medium and moderately fine texturod surfaces, and moderately fine textured subsoils. Moderately slow and slow permeability. Annual precipitation is 38 to 90 inches.	A and B	Slight	Moderate	Slight	174 (2)	200 (1)	Moderate	Severe	Low
	C	Moderate	Moderate						
Group 6. Deep, moderately well drained high terrace soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. Moderately slow permeability. Annual precipitation is 50 to 70 inches.	A and B	Slight	Slight		166 ± 5 (27)	--	High	Moderate to Severe	Low
	C and D	Moderate	Moderate	Slight					
	E	Severe	Sevore						

Table 8 (Continued)

Soil Group and Description	Slope Classes 2/	Erosion Hazard	Equipment Limitations	Windthrow Hazard	Potential Soil Productivity Average Site Index 3/ Douglas Fir	Potential Soil Productivity Average Site Index 3/ Western Hemlock	Potential For Minor Understory Forest Products 4/	For Douglas Fir: Plant Competition	For Douglas Fir: Christmas Tree Potential
Group 7. Moderately deep and shallow, imperfectly drained high terrace soils with medium and moderately fine textured surfaces, and moderately fine and fine textured subsoils. Slow and very slow permeability. Annual precipitation is 50 to 90 inches.	A	Slight	Severe						
	B and C	Moderate	Severe	Moderate to Severe	(157 ± 8 (49)	--	Low	Severe	Low
	D and E	Severe	Severe						
Group 8. Moderately deep and deep, well drained upland soils with stony and cobbly medium and moderately coarse textured surfaces, and moderately fine and medium textured subsoils. Moderately slow and slow permeability. Precipitation is 45 to 70 inches.	A and B	Slight	Slight to Moderate						
	C and D	Moderate	Moderate to Severe	Slight	(140 ± 2 (13)	--	Low to Medium	Slight to Moderate	Medium
	E and F	Severe	Severe						
Group 9. Deep, well drained upland soils with medium textured surfaces, and medium and moderately fine textured subsoils. Permeability is moderate. Annual precipitation is 60 to 100 inches.	A and B	Slight	Slight						
	C and D	Moderate	Moderate	Slight	142 (6)	--	Low	Slight	Medium to High
	E	Severe	Severe						
Group 10. Moderately deep, moderately well drained high terrace soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. The lower subsoils are fine textured, hard, very firm and slowly permeable. Annual precipitation is 50 to 70 inches.	A	Slight	Severe						
	B and C	Moderate	Moderate	Moderate to Severe	135 ± 7 (14)	--	High	Severe	Low
	D,E, and F	Severe	Severe						
Group 11. Moderately deep, excessively and somewhat excessively drained terrace soils. The surface soils are gravelly and stony medium to coarse textures, and the subsoils are medium to coarse textures. Permeability of the subsoils is rapid to very rapid. Annual precipitation is 45 to 70 inches.	A,B, and C	Slight	Slight						
	D	Moderate	Moderate	Slight	140 ± 12 (33)	--	Medium to High	Slight	Medium to High
	E and F	Severe	Severe						
Group 12. Deep and moderately deep, well drained and moderately well drained terrace soils with medium and moderately fine textured surfaces and moderately fine textured subsoils. The permeability is moderate and moderately slow. Precipitation is 45 to 70 inches.	A and B	Slight	Slight						
	C and D	Moderate	Moderate	Slight	150 ± 6 (92)	--	Medium to High	Slight to Moderate	Low to Medium
	E and F	Severe	Severe						

Table 8 - Woodland Suitability Groupings of Soils with Interpretations for Management and Treatment, Southwest Washington

(Continued)

Soil Group and Description 1/	Slope Classes 2/	Erosion Hazard	Equipment Limitations	Windthrow Hazard	Potential Soil Productivity Average Site Index 3/ Douglas Fir	Potential Soil Productivity Average Site Index 3/ Western Hemlock	Potential For Minor Understory Forest Products 4/	For Douglas Fir: Plant Competition	For Douglas Fir: Christmas Tree Potential
Group 13. Moderately deep, well drained and moderately well drained upland soils with moderately fine and medium textured surfaces, and moderately fine textured subsoils. Permeability is moderately slow. Annual precipitation is 45 to 70 inches.	A	Slight	Slight		157 ± 9 (75)	--	High	Moderate	Low
	B,C, and D	Moderate	Moderate	Slight					
	E and F	Severe	Severe						
Group 14. Moderately deep and deep somewhat excessively drained terrace soils with moderately coarse and coarse textured surfaces, and coarse and moderately coarse textured subsoils. Some soils have gravel, cobbles, or stone in their profiles. Permeability is rapid to very rapid. Annual precipitation is 45 to 70 inches.	A and B	Slight	Slight		151 ± 7 (13)	--	Medium	Slight to Moderate	Medium
	C	Moderate	Slight	Slight					
Group 15. Deep, well drained upland soils formed in volcanic alluvium. The surface soils are medium textured. Subsoils are medium textured, hard, firm and slowly permeable. Annual precipitation is about 100 inches.	A	Slight	Slight		110 (3)	--	Low	Slight	High
	B,C, and D	Moderate	Slight to Moderate	Slight					
	E and F	Severe	Severe						
Group 16. Moderately deep, imperfectly drained upland soils with moderately fine textured surfaces, and fine textured subsoils. Permeability is very slow. Annual precipitation is 72 to 100 inches.	A	Slight	Moderate		105 (1)	--	Low	Moderate	High
	B and C	Moderate	Moderate	Slight					
	D and E	Severe	Severe						
Group 17. Shallow and moderately deep, imperfectly drained and well drained upland and high terrace soils with coarse and moderately coarse textured surfaces, and hard, very firm, compact or cemented lower subsoils. Permeability is slow. Annual precipitation is 50 to 100 inches.	A	Slight	Moderate		94 (2)	--	High	Severe	Low
	B,C, and D	Moderate	Moderate	Severe					
	E and F	Severe	Severe						

Table 8 (Continued)

Soil Group and Description 1/	Slope Classes 2/	Erosion Hazard	Equipment Limitations	Windthrow Hazard	Potential Soil Productivity Average Site Index 3/ Douglas Fir	Potential Soil Productivity Average Site Index 3/ Western Hemlock	Potential For Minor Understory Forest Products 4/	For Douglas Fir: Plant Competition	For Douglas Fir: Christmas Tree Potential
Group 18. Moderately deep and shallow, poorly drained, bottomland and terrace basin soils with medium and moderately fine textured surfaces, and fine textured subsoils. Permeability is slow to very slow. Annual precipitation is 50 to 90 inches.	A	Slight	Severe		) (				
	B and C	Moderate	Severe	Severe	)126 ± 3 (6)	--	Medium	Severe	Low
Group 19. Moderately deep and shallow, excessively drained bottomland soils subject to periodic overflow. Surface soils have moderately coarse, coarse and medium textures, and subsoils have coarse textures. Permeability is rapid to very rapid. Annual precipitation is 50 to 70 inches.	A	Moderate to Severe	Slight	Slight	Not Suited	Not Suited	Low	Moderate to Severe	Low
Group 20. Moderately deep, poorly drained bottomland and terrace basin soils with medium, moderately fine, fine and coarse textured surfaces, and fine textured subsoils. Very slow permeability. Annual precipitation is 50 to 100 inches.	A	These soils are used primarily for cultivated crops and no woodland ratings have been developed.							

Footnotes

1/ See the narrative discussion of each group for a listing of the soils; also see Table 9 for a summary of the generalized characterization of the soils within each group.

2/ Ranges of slope gradients in percent, segregated and identified as follows: A, 0-3%; B, 3-8%; C, 8-15%; D, 15-30%; E, 30-45%; F, 45% plus.

3/ First figures denote average site index as determined from the sample data; second (plus or minus) figures indicate standard deviation of the data; figures in parentheses indicate size of sample (number of sample plots). For practical use, this average value should be regarded as the approximate central value of a site quality class with an approximate range indicated by the standard deviation where this is shown. Where there were not enough plots to calculate a standard deviation the approximate range should be regarded as about plus or minus 10. It is assumed that the average values shown and their approximate ranges apply to all soils within each group even though they were not all sampled.

4/ Raw products of the forest, other than logs, poles, and pulpwood; in this case, principally floral greenery and cascara bark.

Table 9. Generalized Soils Information by Woodland Suitability Groups

Woodland Suitability Group	Depth Class	Drainage Class	Profile Textures	Surface Textures	Permeability	Average Annual Precipitation (inches)	Land Form
1	Deep and very deep	Well	Moderately fine	Medium and moderately fine	Moderate and moderately slow	50 to 100	Upland
2	Moderately deep	Well	Moderately fine	Medium and moderately fine	Moderate	90 to 100	Upland and high terraces
3	Deep	Well and somewhat excessive	Moderately coarse	Medium	Moderate, Moderately rapid and rapid	45 to 70	Bottomlands
4	Very deep	Well and moderately well	Moderately fine	Medium and moderately fine	Moderate and moderately slow	45 to 70	Upland and high terraces
5	Very deep to deep	Well, moderately well, imperfect	Moderately fine	Medium and moderately fine	Moderately slow and slow	38 to 90	Bottomland
6	Deep	Moderately well	Moderately fine	Medium and moderately fine	Moderately slow	50 to 70	High terrace
7	Moderately deep and shallow	Imperfect	Moderately fine and fine	Medium and moderately fine	Slow and very slow	50 to 90	High terrace

Table 9. Generalized Soils Information by Woodland Suitability Groups - (Continued)

Woodland Suitability Group	Depth Class	Drainage Class	Profile Textures	Surface Textures	Permeability	Average Annual Precipitation (inches)	Land Form
8	Moderately deep and deep	Well	Moderately fine and medium	Stony and cobbly, medium and moderately coarse	Moderately slow and slow	45 to 70	Upland
9	Deep	Well	Medium and moderately fine	Medium	Moderate	60 to 100	Upland
10	Moderately deep	Moderately well	Moderately fine	Medium and moderately fine	Slow	50 to 70	High terrace
11	Deep	Excessive and somewhat excessive	Medium and coarse	Gravelly and stony, medium and coarse	Rapid and very rapid	45 to 70	Terrace
12	Deep and moderately deep	Well and moderately well	Moderately fine	Medium and moderately fine	Moderate and moderately slow	45 to 70	Terrace
13	Moderately deep	Well and moderately well	Moderately fine	Moderately fine and medium	Moderately slow	45 to 70	Upland

Table 9. Generalized Soils Information by Woodland Suitability Groups - (Continued)

Woodland Suitability Group	Depth Class	Drainage Class	Profile Textures	Surface Textures	Permeability	Average Annual Precipitation (inches)	Land Form
14	Moderately deep and deep	Somewhat excessive	Coarse and moderately coarse	Moderately coarse and coarse	Rapid and very rapid	45 to 70	Terrace
15	Deep	Well	Medium	Medium	Slow	100	Upland
16	Moderately deep	Imperfect	Fine	Moderately fine	Very slow	70 to 100	Upland
17	Shallow and moderately deep	Imperfect and well	Moderately coarse	Coarse and moderately coarse	Slow	50 to 100	Upland and high terraces
18	Moderately deep and shallow	Poor	Fine	Medium and moderately fine	Slow and very slow	50 to 90	Bottomland and terrace basin
19	Moderately deep and shallow	Excessive	Coarse	Coarse, moderately coarse and medium	Rapid and very rapid	50 to 70	Bottomland
20	Moderately deep	Poor	Fine	Medium, moderately fine, fine and coarse	Very slow	50 to 100	Bottomland and terrace basin

Woodland Suitability Group No. 1

These are very deep and deep, well drained upland soils with medium and moderately fine textured surfaces and moderately fine textured subsoils. Permeability is moderate to moderately slow. Annual precipitation is 50 to 100 inches. 1/ Mapping units of the following soils are in this group:

Astoria silty clay loam
Belle silt loam
Germany silt loam*
Hoquiam clay loam
Hoquiam gravelly loam
Hoquiam silt loam
Knappa silt loam, high rainfall
Tebo clay loam
Tebo gravelly loam
Tebo loam
Tebo stony clay loam
Vader loam

Erosion hazard is considered slight on A and B slopes, up to 8%. The hazard increases slightly on C and D slopes, up to 30%. It is severe on E slopes and over, greater than 30%. As slopes increase and the hazard becomes increasingly more severe, additional precautions need to be taken to reduce soil damage. More intensive treatments, specialized equipment, and more exacting methods of equipment operation will be necessary to minimize soil deterioration by accelerated erosion when the steeper soil phases are used in woodland production. For instance, special attention needs to be given to pre-planning the kind, location, and maintenance of roads, skid trails, landings, fire lanes, etc., before woodland management activity begins. Provisions should be made in planning to accomplish prompt stabilization of soil scars following logging on the steeper soils.

Equipment limitations are due to soil profile characteristics and to slope. On slopes up to 30% the only important problem may be wetness during and following heavy winter rains. Good internal drainage soon alleviates this difficulty and logging may proceed intermittently throughout the winter months without undue soil damage. Soil compaction may occur, however, on all slopes if heavy equipment is used during wet periods. Tree roots may thus be injured, and soil drainage restricted, with a general deterioration of the growing site. On the steeper slopes, above 30%, equipment used during the winter months will be sharply curtailed. Specialized equipment is needed for efficient operation and to protect the site on the steeper phases.

Windthrow rarely occurs on these deep soils.

1/ In the case of Knappa silt loam, the only areas included are where total annual precipitation is greater than 70 inches.

* Tentative series.

These soils are well-suited to a variety of commercially important timber species. At present, a priority listing would be Douglas fir, western hemlock, western red cedar, and red alder except for the Hoquiam soils in which case western hemlock appears to be best suited.

Potential soil productivity is very good for both Douglas fir and western hemlock. Average site indexes are 185 and 175 for these species, respectively. (Site index information is not available for the other suitable species.) Average annual growth of fully stocked, unmanaged, 70-year old stands of Douglas fir and western hemlock is about 970 and 1500 board feet (Scribner) per acre, respectively (Appendix Figure 2). As a guide for pulpwood production, similar stands over the same rotation period would produce 195 and 264 cubic feet acre per year, respectively (Appendix Figure 1).

These soils are also well suited to the growth and development of several commercially important forest understory species. Sword fern, salal, and coast evergreen huckleberry usually abound on these soils and, in some localities, are regularly harvested and marketed as floral greenery.

Plant competition which hampers growth of naturally occurring, hand planted or artificially seeded Douglas fir seedlings and saplings is rated severe on four of these soils: Astoria, Belle, Knappa, and Hoquiam. The effects of brush encroachment and competition on Douglas fir is moderate for the remaining soils. Adequate and prompt regeneration of Douglas fir in clear-cut openings of mature stands cannot ordinarily be expected without intensive site preparation and some follow-up maintenance treatment such as weeding. The potential magnitude of the problem on these soils is reflected by their ratings. Natural, fully-stocked stands of mixed species will undoubtedly develop rapidly, but the percentage of red alder, western hemlock, and western red cedar will be high in comparison to the amount of Douglas fir that is able to survive the heavy early competition. Advance reproduction of hemlock and red cedar, growing under thinned Douglas fir stands, will reduce the proportion of surviving Douglas fir seedlings following a final harvest cut. Also, such species as swordfern, salal, evergreen huckleberry, salmonberry, and vine maple expand rapidly in newly created openings and present formidable shade competition for intolerant Douglas fir.

These soils are rated low for Douglas fir Christmas tree production because twig and leader growth is much too rapid. Intensive cultural measures such as leader pruning, twig shearing, and stem debarking would be essential to produce a dense marketable Christmas tree.

Woodland Suitability Group No. 2

These are moderately deep, well drained upland and high terrace soils with medium and moderately fine textured surfaces, moderately fine textured subsoils, and cemented gravel substrata. Permeability is moderate. Annual precipitation is 90 to 100 inches. Mapping units of the following soils are in this group:

Copalis clay loam
Copalis gravelly silt loam
Grisdale loam*
Moclips gravelly silt loam*
Moclips clay loam*

Erosion on these soils is not a problem on the A and B slopes, up to 8%. It is a moderate problem on the steeper C and D phases, up to approximately 30%.

Operation of motorized equipment is moderately restricted when soils are wet. Heavy rainfall during the winter and early spring months combines with soil characteristics to limit most woodland operations except in the late spring, summer, and fall seasons.

Windthrow is a potential hazard to the forest crop because the moderately deep rooting layers become saturated during wet periods and do not give trees complete anchorage against the wind. Conservative thinning or harvest-cut specifications need to be followed on these soils.

Douglas fir is not well suited to these soils even though it is commonly found on them and will grow when planted. Sitka spruce or western hemlock, often occurring in dense stands, do well, and sometimes are found in mixtures along with western red cedar and red alder.

Productivity for spruce and hemlock appears to be very good. One plot indicated a site index of 161 for western hemlock, but no measurement information is currently available for other suitable species. Average annual per acre growth of 70-year old, well-stocked, unmanaged hemlock on these soils is about 1260 board feet, Scribner, or about 240 cubic feet (Appendix Figures 1 and 2).

There is a good potential for growth of understory commercial greenery on these soils.

Plant competition to Douglas fir is rated severe. This limitation may account for the scarcity of Douglas fir on these soils. Regeneration of the most suited species - Sitka spruce and western hemlock - is very rapid, as it is also with western red cedar and red alder. Seedlings of these shade tolerant conifers often become well established prior to logging of the mature overstory, especially if the old stand has been opened slightly by thinning. Rarely does red alder compete successfully with conifers on these soils.

Potential for Douglas fir Christmas tree production is considered low due to competing vegetation and too rapid twig and leader growth.

* Tentative series.

Woodland Suitability Group No. 3

These are deep, well drained and somewhat excessively drained bottomland soils with medium textured surfaces, and moderately coarse textured subsoils. Permeability is moderate to rapid. Annual precipitation is 45 to 70 inches. Mapping units of the following soils are in this group:

Chehalis (Cloquato)* loam
Cloquato (Chehalis)* silt loam
Chehalis silt loam, mottled subsoil
Gardner silt loam*
Humptulips silt loam*
Juno loam
LeBar silt loam
Merwin gravelly silt loam*
Merwin silt loam*
Newberg loam
Newberg loam, deep
Newberg loam, moderately deep
Newberg silt loam
Pilchuck silt loam
Puget silt loam
Puyallup loam
Puyallup silt loam
Puyallup very fine sandy loam
Puyallup fine sandy loam, very deep
Puyallup fine sandy loam, deep
Siler fine sandy loam
Siler silt loam
Sultan silt loam
Vancouver loam*

Erosion is no problem on A and B (0-8%) slopes. Conservation practices of moderate intensity are needed on the C slopes (8-15%) to prevent erosion damage.

Equipment may operate during most of the year on these soils without causing soil and tree.root damage. Operations should cease during periods of heavy rain. On 8-15% slopes moderate limitations in equipment use may be expected, especially during wet weather.

Windthrow is no problem on any of these soils.

Douglas fir productivity is very good, represented by an average site index of 186. Mean annual growth in fully stocked unmanaged Douglas fir stands - on a 70 year rotation - is about 970 board feet, Scribner, or about 195 cubic feet per acre (Appendix Figures 1 and 2). No site index measurements are available for western hemlock, sitka spruce, red alder, or big-leaf maple; but it has been observed that these species also do well on these soils.

* Tentative series

Very little understory floral greenery of commercial quality occurs on these soils.

Young Douglas fir stands have a moderate to severe plant competition problem. Brushy species encroach rapidly into newly created openings and clear-cut areas. Spruce, hemlock and red cedar are able to compete successfully with the broadleaf brushy species, but to regenerate Douglas fir successfully requires moderately intensive site preparation and weeding operations.

The potential of these soils for Douglas fir Christmas tree production is rated low because of the intense brush competition problem.

Woodland Suitability Group No. 4

These are very deep, well drained and moderately well drained upland and high terrace soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. Permeability is moderate to moderately slow. Annual precipitation is 45 to 70 inches. Mapping units of the following soils are in this group:

Cinebar silt loam
Cinebar stony silt loam
Kelso silt loam
Melbourne silt loam
Olympic clay loam, deep
Olympic cobbly silt loam
Olympic cobbly silt loam, deep
Olympic gravelly silt loam
Olympic silt loam, deep
Prather silty clay loam
Salkum clay loam, deep
Salkum silty clay loam, deep
Seaquest clay loam*
Wadell loam
Wadell silty clay loam
Wadell stony silty clay loam
Willamette silt loam
Winlock silt loam
Winlock silty clay loam

The erosion hazard is a function of slope on this group of soils. It is considered slight on the A and B slopes. On C and D slopes (8-30%) soil protective measures of medium intensity need to be practiced during woodland management operations. On slopes over 30% (E and over) the eorsion hazard is severe, and intensive conservation practices need to be followed to protect the soil.

* Tentative series

Limitations in the use of equipment also increases with slope. Usually no problems are encountered due to soil wetness except during periods of heavy rain. On slopes above 30%, especially designed methods of equipment operation and special kinds of equipment need to be considered.

No hazard is evident from windthrow on these soils.

Douglas fir, western hemlock, western red cedar, and red alder are well suited to these soils. Red alder, big leaf maple, and other broadleaf trees may occupy these soils following a clear-cut harvest. Moderate site preparation treatments and follow-up weeding may be needed to assure adequate stocking and growth of the best suited conifers.

Productivity for Douglas fir is very good as evidenced by an average site index of 176. When translated into average annual growth for a 70 year rotation, one may expect about 880 board feet, Scribner, or about 186 cubic feet per acre from fully stocked, unmanaged stands (Appendix Figures 1 and 2). Other species rarely occur in pure stands on these soils, but are often found in mixture with Douglas fir.

There is a moderate potential for the production of commercial floral greenery in the understory of forest stands on these soils. This is made up mostly of Oregon grape and swordfern.

Regenerating Douglas fir encounters moderate to severe competition from the broadleaf species mentioned above, as well as from fern and low brush.

Intensive cultural treatments each year are required to produce Douglas fir Christmas trees on these soils.

Woodland Suitability Group No. 5

These are very deep, deep and moderately deep well drained, imperfectly and moderately well drained bottomland soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. Permeability is moderately slow and slow. Annual precipitation is 38 to 90 inches. Mapping units of the following soils are in this group:

Brenner silt loam*
Chehalis silty clay loam
Cowlitz silt loam*
Cowlitz silty clay loam*
Grande Ronde silt loam
Grande Ronde silty clay loam
Maytown loam
Maytown silt loam

* Tentative series

Maytown silty clay loam
Nehalem silt loam
Sauvie silt loam
Sauvie silt loam, fine sandy loam subsoil
Sauvie silty clay loam

Normally there is little hazard from erosion on these soils. The upper slope gradients, which do not exceed 15%, may require moderate precautions to prevent gullying along logging roads and skid trails.

There is a moderate limitation in the use of trucks, tractors, and other wheel-type equipment on these soils. Heavy winter rainfall combined with slow permeability within these soils make them somewhat soft and unstable when wet. This may require a seasonal restriction in wheel-type equipment operations, or specialized equipment such as track-type tractors my be necessary when soils are wet.

There is no problem from windthrow on this group of soils.

Suitable species are: western hemlock, black cottonwood, Douglas fir, western red cedar, red alder, and big-leaf maple.

Productivity is very good for Douglas fir and excellent for western hemlock. Average site index is 174 and 200 for these species respectively. Mean annual growth per acre, of fully-stocked, unmanaged 70-year old stands is about 860 board feet, Scribner, or about 182 cubic feet for Douglas fir and over 1800 board feet, Scribner, or over 300 cubic feet for western hemlock (Appendix Figures 1 and 2). Similar information is not currently available for the other suitable species.

A moderate potential for the production of minor understory forest products comprising mainly swordfern, Oregon grape and cascara bark is recognized.

Plant competition to regenerating Douglas fir is a serious problem. Red alder and other broadleaf species quickly invade openings following clear-cutting or similar stand disturbance. Intensive site preparation should immediately precede hand planting of Douglas fir seedlings. Weeding probably will be required in Douglas fir plantations 3-5 years following planting.

Production of marketable Douglas fir Christmas trees is considered uneconomical because of intensive treatment measures needed to retard leader and twig growth.

Woodland Suitability Group No. 6

These are deep, moderately well drained high terrace soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. Permeability is moderately slow. Annual precipitation is 50 to 70 inches. Mapping units of the following soils are in this group:

Delphi gravelly loam
Dobler silt loam*
Glenoma loam
Glenoma silt loam
Haapa silt loam*
Knappa silt loam, medium rainfall phase
Olequa silt loam
Skamokawa silt loam*
Skamokawa silty clay loam*

Erosion is not a problem on A and B (0-8%) slopes. On the C and D slopes (8-30%), there is a moderate hazard and on E slopes, above 30%, the hazard becomes severe. The intensity of erosion control treatments to minimize soil damage during woodland management operations is reflected by these ratings.

Equipment limitations vary from slight on A and B slopes to moderate on C and D slopes. Above 30% (E slopes), the limitation is severe and specialized equipment may be needed and seasonal operations should be considered.

Windthrow is not a problem on this group of soils.

The species best suited to this group of soils are Douglas fir, western hemlock, western red cedar, and red alder.

Productivity is very good for both Douglas fir and western hemlock as indicated by an average site index of 166 and 186 respectively. Mean annual growth per acre, of fully stocked, unmanaged, 70 year old stands are expected to be about 780 board feet, Scribner, or 176 cubic feet for Douglas fir and about 1650 board feet, Scribner, or about 280 cubic feet for western hemlock (Appendix Tables 1 and 2). Similar information is not currently available for the other suitable species.

The potential for minor forest products is considered to be high. The salable species found here are Oregon grape, swordfern, and salal.

There is a moderate to severe problem of plant competition to Douglas fir seedlings and saplings.

Potential for marketable Douglas fir Christmas tree production is low because of the rapid leader and twig growth.

Woodland Suitability Group No. 7

These are moderately deep and shallow, imperfectly drained, high terrace soils with medium and moderately fine textured surfaces, and moderately fine and fine textured subsoils. Permeability is slow and

* Tentative series

very slow. Annual precipitation is 50 to 90 inches. Mapping units of the following soils are in this group:

Brenner silty clay loam*
Clove silt loam, deep*
Dryad silt loam
Dryad silty clay loam
Galvin loam
Galvin silt loam
Galvin silty clay loam
Hockinson silt loam*
Klaber silt loam, gravelly subsoil
Klaber silty clay loam
Klaber silty clay loam, gravelly subsoil
Lubke silty clay loam (See Scammon)*
Meskill silt loam
Meskill silty clay loam
Nesika clay loam
Onalaska silt loam
Onalaska silty clay loam
Puget silty clay loam
Scammon silt loam*
Scammon silty clay loam*
Viola clay loam
Viola silt loam
Viola silty clay loam

A moderate erosion problem exists on B and C slopes between about 5% and 15%. The problem becomes severe on D and E slopes (steeper than 15%). Moderate and intensive conservation treatments, specialized equipment, and careful equipment operations are necessary to avoid soil damage on the steeper slopes.

Limitations on the use of equipment in woodland management operations are severe on these soils. These limitations are related to soil structure and wetness and becomes increasingly more important on the steeper phases. These soils occur in areas of high rainfall and because of slow internal drainage, they are unstable when wet and do not support equipment well or provide traction. These wet periods occur during much of the year but are most prevalent during the winter months.

Windthrow is a moderate to severe problem on these soils. The combination of shallowness and excessive wetness during much of the year prevents adequate tree anchorage against wind. Severe thinning is therefore hazardous to the remaining stand of trees. Brenner, Galvin, Hockinson, Nesika, Onalaska, and Puget soils being somewhat deeper than the others in the group, are rated as having a moderate windthrow problem, whereas the others are rated severe in this respect.

* Tentative series

Suitable species are: Douglas fir, western hemlock, western red cedar, and red alder.

Potential soil productivity is very good for Douglas fir, being indicated by an average site index of 157. No data are available for the other species. A fully stocked, unmanaged 70 year old stand of even-aged Douglas fir can be expected to show an average growth of 680 board feet, Scribner, or 165 cubic feet per acre per year (Appendix Figures 1 and 2).

The potential for minor understory forest products is low for the soils of this group. The understory consists mainly of water loving species which are presently of no value commercially.

Douglas fir seedlings receive severe plant competition from brushy species which abound on these wet soils.

The potential for Douglas fir Christmas trees is considered low. Leader growth is rapid and competition from rank underbrush creates an unfavorable cultural situation.

Woodland Suitability Group No. 8

These are moderately deep and deep, well drained upland soils with stony and cobbly, medium and moderately coarse textured surfaces, and moderately fine and medium textured subsoils. Permeability is moderately slow and slow. Precipitation is 45 to 70 inches. Mapping units of the following soils are in this group:

Kinney cobbly silt loam
Kinney stony silt loam
Larch Mountain cobbly silt loam*
Larch Mountain very stony silt loam*
Melbourne stony clay loam
Melbourne stony loam
Olympic stony clay loam
Olympic stony loam
Olympic stony silt loam
Olympic stony silty clay loam
Salkum very stony silty clay loam
Salkum very stony silty clay loam, moderately shallow
Skamania silt loam
Skamania very fine sandy loam
Stevenson clay loam
Stevenson gravelly clay loam
Stevenson stony clay loam
Stevenson stony loam
Yacolt cobbly silt loam*
Yacolt stony silt loam*

* Tentative series

The potential erosion hazard is rated slight to severe, depending on slope. On E and F slopes, above 30%, intensive conservation treatment measures, special equipment, and careful operating methods are required to prevent soil deterioration.

There are certain limitations on the use of heavy equipment on all slope classes. Slight to moderate restrictions on the undulating and gently rolling slopes (A and B) are related to slow permeability and resultant wetness during the rainy portions of the year. Rolling and hilly slopes (C and D) are rated moderate to severe because of wetness and the presence of stones and cobbles at and near the surface. On the steeper E and F slopes these same soil characteristics increase trafficability problems and specialized equipment and operating methods are needed, together with a restriction in season of operations.

Windthrow is only a slight problem on this group of soils.

Douglas fir is the principal species suited to this group of soils although western hemlock and western red cedar are occasionally found in mixture with Douglas fir.

The productivity for Douglas fir is good, indicated by an average site index rating of 140. Average annual growth per acre of Douglas fir expected from fully stocked, unmanaged, even-aged stands 70 years of age, is about 510 board feet, Scribner, or about 140 cubic feet (Appendix Figures 1 and 2).

Potential for minor understory products on these soils is low to medium.

Competition from brushy species that invade or develop when regeneration openings are made in the canopy is expected to be slight to moderate for Douglas fir seedlings. Some site preparation and weeding measures may be beneficial on lower slope positions but ordinarily restocking and growth is not significantly affected by adverse plant competition.

Potential for producing marketable Douglas fir Christmas trees is considered medium, although some cultural measures may be desirable to retard twig and leader growth that is usually too rapid for the most desirable product.

Woodland Suitability Group No. 9

These are deep, well drained upland soils with medium textured surfaces, and medium and moderately fine textured subsoils. Permeability is moderate. Annual precipitation is 60 to 100 inches. Mapping units of the following soils are in this group:

Bear Prairie silt loam*

*Tentative series

Carstairs gravelly loam
Chelatchie loam*
Doty silt loam
Malone gravelly loam
Mossyrock loam
Mossyrock silt loam
Quillayute silt loam
Tillamook silt loam*

These are known as "prairie soils." Occasional small treeless openings are found on them within the natural timber cover. These openings are usually occupied by fern or grasses but Douglas fir and lodgepole pine seedlings are encroaching into these openings and may eventually occupy them.

Erosion is a moderate hazard on the C and D (8-30%) slopes. On E slopes, steeper than 30%, the potential erosion hazard is severe and appropriate conservation measures need to be considered in management.

Equipment limitations vary directly with steepness of slope and are considered to be severe on E slopes greated than 30%.

Windthrow is not a problem on these deep, well drained soils.

Potential productivity of this group of soils is considered to be only fair, although on Bear Prairie silt loam several observations revealed an average site index of 142. An average value of 120 may be more realistic, in which case an average annual growth for well-stocked, unmanaged, 70 year old stands of Douglas fir of about 290 board feet, Scribner, or about 150 cubic feet per acre may be assumed.

There is no potential for minor understory forest products on these soils and plant competition is not expected to be a problem for Douglas fir or lodgepole seedlings and saplings.

Because of the relative slow growth of Douglas fir on these soils a medium to high potential for marketable Christmas trees is indicated.

Woodland Suitability Group No. 10

These are moderately deep, moderately well drained high terrace soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. The lower subsoils are fine textured, hard, very firm and slowly permeable. Annual precipitation is 50 to 70 inches. Mapping units of the following soils are in this group:

Cloquallum silt loam, nearly level
Cloquallum silty clay loam, nearly level

* Tentative series

Powell silt loam
Salkum silty clay loam, shallow
Salkum silty clay loam, moderately deep
Sara silt loam*
Sara silt loam, moderately shallow*

Soil erosion hazard varies directly with steepness of slope. A moderate hazard may be expected on B and C slopes whereas on the D, E, and F slopes it is considered severe. Intensive conservation treatment measures, use of specialized equipment, and careful operating methods are required, especially on slopes over 30%, if soil damage is to be avoided following woodland operations.

Equipment limitations are severe on the A slopes of this group of soils because of prolonged wetness, and severe on the D, E, and F slopes because of steepness. Drainage is more rapid on the medium and steeper slopes, and equipment limitations are considered to be moderate on the B and C slope phases.

Soil profile characteristics cause these soils to be saturated with water during rainy periods. The lower subsoil is restrictive to adequate tree rooting. Consequently there is a moderate to severe problem of windthrow. Thinning intensity and strategic locations of clear-cut logging area boundaries will require careful advance planning in order to minimize windthrow losses in the residual stands.

Species best suited to this group of soils are Douglas fir, western hemlock, western red cedar, and red alder.

Potential productivity for Douglas fir is good, indicated by an average site index of 135. Average annual growth of about 450 board feet, Scribner, or 136 cubic feet per acre may be expected from fully-stocked, unmanaged, even-aged stands of Douglas fir over a period of 70 years. (Appendix Figures 1 and 2).

The potential for minor understory forest products is high.

Plant competition for Douglas fir seedlings and saplings is considered severe on these soils. Site preparation and one or two weeding operations may be required to regenerate a crop of Douglas fir.

The potential for Douglas fir Christmas tree production is considered low because of cultural difficulties related to the intense plant competition from brushy species.

Woodland Suitability Group No. 11

These are moderately deep, excessively and somewhat excessively drained terrace soils. Surfaces are gravelly and stony and are medium to coarse

* Tentative series

textures. Subsoils are medium to coarse textures. Permeability of the subsoils is rapid to very rapid. Annual precipitation is 45 to 70 inches. Mapping units of the following soils are in this group:

Bonneville loam
Bonneville gravelly loam
Bonneville stony loam
Camas gravelly loam
Camas gravelly silt loam
Hazel Dell sandy loam*
Hidden loam*
Hidden fine gravelly loam*
Lauren gravelly loam
Lauren gravelly loam, moderately shallow
Lauren loam
Lauren loam, moderately shallow
Nasel gravelly loam
Roper cobbly loam*
Roper gravelly loam*
Roper stony loam*
Sifton gravelly loam*
Sifton gravelly loam, shallow*
Wind River gravelly loam
Winston gravelly loam
Winston gravelly sandy loam
Winston loam
Winston silt loam

Erosion hazard is related to soil texture and slope gradient on these soils. On D slopes (20 to 30%), moderately intensive conservation treatment, and careful methods of equipment operation are required to avoid soil damage. On E and F slopes, greater than 30%, specialized equipment may also be required.

Equipment limitations are directly related to slope gradient and to surface stoniness. The relative degree of limitation follows the same pattern as that for erosion hazard, being slight on A, B, and C slopes, moderate on D slopes and severe on E and F slopes. Specialized equipment may be required for effective operations on slopes greater than 30%.

Windthrow hazard on this group of soils is considered slight.

The most suitable commercial tree species for this group of soils is Douglas fir. Western hemlock and western red cedar may be found on them but are not expected to produce satisfactorily.

Potential productivity for Douglas fir is good as indicated by an average site index of 140. Expected average annual growth per acre, for a 70 year rotation, in a fully-stocked, unmanaged, even-aged stand

* Tentative series

of Douglas fir is about 500 board feet, Scribner, or about 140 cubic feet (Appendix Figures 1 and 2).

The potential for minor understory forest products such as Oregon grape, swordfern, and evergreen huckleberry is considered to be medium to high.

Plant competition affecting regeneration and early growth of Douglas fir is expected to be slight on these soils and the rating for Christmas tree production of Douglas fir is medium to high.

Woodland Suitability Group No. 12

These are deep and moderately deep, well drained and moderately well drained, terrace soils with medium and moderately fine textured surfaces, and moderately fine textured subsoils. The permeability is moderate and moderately slow. Precipitation is 45 to 70 inches. Mapping units of the following soils are in this group:

Camas clay loam
Chemawa shotty loam
Cinebar gravelly silt loam
Cloquallum silt loam, rolling
Cloquallum silty clay loam, rolling
Delp fine sandy loam*
Delp loam*
Dollar silt loam*
Dollar silt loam, deep*
Dollar silt loam, shallow*
Elma silt loam
Felida silt loam
Gee silt loam*
Gee silt loam, very deep*
Hesson clay loam
Hesson gravelly clay loam
Hillsboro silt loam
Hillsboro bouldry silt loam
Marthen silt loam
Nesika loam
Nesika gravelly loam
Parkdale silt loam
Peterson clay loam*
Peterson silt loam*
Salkum silt loam
Salkum silty clay loam and clay loam
Yacolt silt loam*

Soil erosion is á moderate hazard on the C and D (8-30%) slopes. On the E and F slopes, steeper than 30%, the hazard is severe and intensive

* Tentative series

conservation treatments, specialized equipment, and improved methods of equipment operation may be necessary to avoid soil deterioration.

Equipment limitations are rated moderate on C and D slopes and severe on E and F slopes. These limitations are a function of soil textures and steepness of slope, and may require seasonal operations and use of specialized equipment, or both. Windthrow hazard is slight.

Species suitable for soils of this group are Douglas fir, western hemlock, and western red cedar. Red alder is also well suited to the Cinebar, Cloquallum, Salkum, Dollar, and Delp soils.

Potential productivity for Douglas fir is good, as indicated by an average site index of 150. The average annual per acre growth expected over a 70 year period on fully-stocked, unmanaged, even-aged stands of Douglas fir is about 600 board feet, Scribner, or about 157 cubic feet. Similar information is not currently available for the other suitable commercial species.

The potential for minor understory forest products, such as swordfern, salal, Oregon grape, evergreen huckleberry, and cascara bark is medium to high.

Competition to Douglas fir seedlings and saplings from brushy species is not a particular problem on this group of soils.

Twig and leader growth is usually so rapid on young Douglas fir trees on these soils that their potential for marketable Christmas trees is rated medium to low.

Woodland Suitability Group No. 13

These are moderately deep, well drained and moderately well drained upland soils with moderately fine and medium textured surfaces, and moderately fine textured subsoils. Permeability is moderately slow. Annual precipitation is 45 to 70 inches. Mapping units of the following soils are in this group:

Bucoda silty clay loam
Melbourne silty clay loam
Olympic clay loam
Olympic silty clay loam
Olympic silt loam
Wilkeson silt loam

Erosion hazard is related to soil texture as well as steepness of slopes on these soils. The hazard is moderate on B, C, and D slopes between 8% and 30%. Above 30%, on E and F slopes, the hazard is severe and intensive conservation treatments, specialized equipment, and careful equipment operating procedures are necessary to minimize soil damage that may be caused by erosion.

Equipment limitations are related to soil texture and wetness in combination with steepness of slope. On E and F slopes, greater than 30%, the limitations are considered severe, and may require the use of specialized equipment, seasonal operations, or both. Windthrow hazard is slight.

Suitable species include Douglas fir, western hemlock, western red cedar, and red alder.

Potential productivity for Douglas fir is very good, indicated by an average site index of 157. Average annual production per acre of Douglas fir in fully-stocked, unmanaged, even-aged stands 70 years of age is estimated to be about 685 board feet, Scribner, or about 166 cubic feet (Appendix Figures 1 and 2). No similar information is currently available for the other suitable species.

Potential productivity for minor understory forest products such as swordfern, salal, Oregon grape, evergreen huckleberry, and cascara bark is considered to be high on this group of soils.

Douglas fir seedlings and saplings will usually encounter moderate competition from brushy species and less desired trees that invade or develop when openings are made in the canopy by logging or other disturbance. Some cultural operations to reduce competition may be advisable but usually are not considered essential in order to get adequate stocking and desirable early growth.

The potential for Douglas fir Christmas trees is considered to be low because of rapid juvenile growth requiring intensive cultural treatments to produce a marketable product.

Woodland Suitability Group No. 14

These are moderately deep and deep, somewhat excessively drained terrace soils, with moderately coarse and coarse textured surfaces, and coarse and moderately coarse textured subsoils. Some soils have gravel, cobbles or stone in their profiles. Permeability is rapid to very rapid. Annual precipitation is 45 to 70 inches. Mapping units of the following soils are in this group:

Burlington fine sand
Cispus pumicy sandy loam
Fiscus silt loam
Juno sandy loam
Newberg sandy loam
Newberg fine sandy loam
Newberg fine sandy loam, deep
Newberg fine sandy loam, moderately deep
Puyallup fine sandy loam
Puyallup sandy loam
Riffe fine sandy loam

Riffe loam
Riffe sandy loam
Toutle loamy fine sand
Toutle loamy sand
Toutle sandy loam
Washougal loam
Washougal gravelly loam
Washougal gravelly fine sandy loam
Washougal silt loam
Westport sand
Wind River loam
Wind River silt loam

Slopes rarely exceed 15% on soils of this group. Erosion is a moderate hazard on the C (8-15%) slopes. Some erosion controlling treatments need to be considered when operating on these C slopes.

There are few limitations on the use of equipment, and these are related to stoniness in the surface layer. Potential loss in forest stands due to windthrow is of slight importance.

Douglas fir and western hemlock are equally suited to most of these soils. On Wind River and Riffe, Douglas fir appears to be the most desirable. Red alder grows well on Puyallup, Newberg, and Fiscus soils.

Potential productivity for Douglas fir is good, as indicated by an average site index of 151. Average annual growth per acre is estimated at about 620 board feet, Scribner, or about 158 cubic feet for fully-stocked, unmanaged, even-aged stands over a growing period of 70 years (Appendix Figures 1 and 2). Similar information is not currently available for western hemlock or red alder.

Potential productivity for minor understory forest products is rated medium for soils of this group

Douglas fir reproduction will normally encounter slight to moderate plant competition from brush and less desirable young tree species that invade or develop on these soils when openings are made in the canopy. Site preparation of medium intensity and some follow-up weeding may be required to obtain immediate and adequate regeneration and desired growth of Douglas fir.

The potential for Douglas fir Christmas tree production is medium, since juvenile growth is somewhat too fast for production of the most desirable product.

Woodland Suitability Group No. 15

These are deep, well drained upland soils formed in volcanic alluvium. The surface soils are medium textured. Subsoils are medium textured, hard, firm and slowly permeable. Annual precipitation is about 100 inches. Mapping units of the following soils are in this group:

St. Helens pumicy sandy loam
Stabler loam
Stabler cobbly loam
Stabler shotty loam
Stabler silt loam

Erosion hazard is related directly to steepness of slopes on these soils. On B, C, and D slopes, between 8%-30%, the hazard is rated moderate. On E and F slopes, greater than 30%, the rating is severe and intensive conservation treatments, specialized equipment and careful methods of equipment operating are necessary to avoid soil damage.

Limitations on use of equipment are due mainly to slope gradient and are considered severe on E and F slopes greater than 30%. Here, specialized equipment may be needed for efficient and safe operation. Windthrow hazard is slight on these soils.

Suitable species are Douglas fir, western hemlock, and western red cedar.

Potential productivity for Douglas fir is fair, being indicated by an average of 110. Average annual per acre growth over a 70 year period in fully-stocked, unmanaged, even-aged stands may be about 200 board feet, Scribner, or about 93 cubic feet (Appendix Figures 1 and 2). No similar information is currently available for other suitable species on these soils.

Potential productivity for minor understory forest products is low.

Little undesirable plant competition to Douglas fir reproduction is expected on these soils following regeneration harvests.

Potential productivity for native Douglas fir Christmas trees of good quality is high because of the slow growth (low site index) and absence of plant competition. However, these soils are inaccessible to Christmas tree markets and this crop is not important at present.

Woodland Suitability Group No. 16

These are moderately deep, imperfectly drained upland soils with moderately fine textured surfaces, and fine textured subsoils. Permeability is very slow. Annual precipitation is 72 to 100 inches. Mapping units of the following soils are in this group:

St. Martins clay loam
St. Martins stony clay loam

Erosion hazard varies directly with the degree of slope but is aggravated by fine textured soil profile characteristics. A moderate hazard is recognized on B and C slopes, 8%-30%, and a severe hazard on D and E slopes, steeper than 30%. Conservation treatments of moderate intensity are required on the B and C slopes but specialized equipment,

careful methods of equipment operation and intensive erosion controlling treatments are necessary on slopes greater than 30% if soil damage is to be prevented.

Equipment use is limited on soils of this group due to soil characteristics, slopes and high rainfall. Moderate restrictions are recognized on A, B, and C slopes. On D and E slopes the limitations are classed as severe. Specialized methods of equipment operations, seasonal work, and specific kinds of equipment may be necessary to obtain efficient and safe woodland management.

Windthrow is of little economic importance on these soils. Douglas fir appears to be the best adapted species.

Potential productivity of Douglas fir is fair on these soils as indicated by an average site index of 105. Average annual growth per acre in fully-stocked, unmanaged, even-aged stands, over a 70 year period should be about 160 board feet, Scribner, or about 84 cubic feet per acre. (Appendix Figures 1 and 2).

Potential productivity for minor understory forest products is low, since commercial species do not normally occur in marketable quantities.

Plant competition affecting Douglas fir reproduction in regeneration openings is considered moderate. Some site preparation may be beneficial to regeneration and growth of a new stand after harvest but it is not considered essential.

Potential productivty for Douglas fir Christmas trees is high, due to slow growth that provides a dense compact tree, and because of only moderate plant competition to young stands.

Woodland Suitability Group No. 17

These are shallow and moderately deep, imperfectly drained and well drained upland and high terrace soils with coarse and moderately coarse textured surfaces, and hard, very firm compact or cemented lower subsoils. Permeability is slow. Annual precipitation is 50 to 100 inches. Mapping units of the following soils are in this group:

Cougar gravelly loamy sand
Cougar gravelly sandy loam
Prindle gravelly clay loam*
Prindle sandy loam

Erosion hazard is related mainly to slope steepness and is rated from slight through moderate to severe. On the E and F slopes, rated severe, intensive erosion controlling treatments, specialized equipment, and careful equipment operations are required to prevent soil damage. Such treatments needs are less intensive on the B, C, and D slopes, rated moderate.

Equipment limitations, related to wetness and slope, create problems on this group of soils. Moderate limitations apply on A, B, C, and D slopes but these are increased to severe on E and F slopes. Seasonal operations are required on all these soils and, on the steeper slopes, there is a need of specialized equipment to make woodland management operation both safe and efficient.

These relatively shallow, coarse textured and imperfectly drained soils have a severe windthrow hazard. Thinning operations should be planned conservatively and boundaries of clear-cut areas located strategically to avoid excessive blowdown of residual stands.

Douglas fir is the most suitable species. Potential productivity is poor, however, indicated by an average site index of 94. Average annual growth per acre over a 70 year period in fully-stocked, unmanaged, even-aged stands is about 100 board feet, Scribner, or about 68 cubic feet (Appendix Figures 1 and 2).

Potential productivity for minor understory products such as salal, Oregon grape, and cascara bark is high.

Plant competition that may invade or develop in regeneration openings is rated severe for Douglas fir seedlings and intensive site preparation with subsequent weeding may be necessary to obtain adequate and immediate regeneration after logging.

The Douglas fir Christmas tree potential is rated low because of the severe brush competition found on these soils.

Woodland Suitability Group No. 18

These are moderately deep and shallow, poorly drained, bottomland and terrace basin soils, with medium and moderately fine textured surfaces, and fine textured subsoils. Permeability is slow to very slow. Annual precipitation is 50 to 90 inches. Mapping units of the following soils are in this group:

Clatsop silty clay loam
Deckerville gravelly loam
Deckerville gravelly silty clay loam
Deckerville silt loam
Deckerville silty clay loam
Everson clay loam
Everson fine sandy loam
Everson silt loam
Gumboot silt loam*
Kopiah silt loam
Kosmos clay loam
Lacamas silt loam
Lacamas silty clay loam
Lubke (Scammon)* silty clay loam, shallow

McCleary gravelly loam*
McKenna gravelly loam
McKenna gravelly clay loam
McKenna loam
Martha clay loam
Martha silt loam
Norma clay loam
Norma loam
Norma silty clay loam
Odne silt loam*
Scammon silty clay loam, shallow
Schooley loam
Schooley silt loam
Viola cobbly silty clay loam
Viola stony silty clay loam
Wapato clay loam
Wapato silt loam
Wapato silty clay loam
Wynoochee silty clay loam

Erosion is a moderate hazard on B and C slopes between 3% and 15%. Some attention to erosion controlling treatment measures may be necessary to protect these soils following management operations.

Equipment limitations are considered severe on all these soils. The limitations are due to soil profile characteristics and rainfall. Slope gradient is of minor concern. Seasonal operations need to be made a part of planned management.

Windthrow is a severe hazard. Thinning treatments should be conservative and boundaries of clear-cut areas located strategically to reduce possible losses due to blowdown.

Most suitable species are those with high moisture requirements. These include such native species as cottonwood, red alder, big leaf maple, Oregon ash and, to some extent, western hemlock, red cedar, and Douglas fir.

Productivity information is available for only Douglas fir. It is considered fair to good as indicated by six sample measurements showing an average site index of 126. During a 70 year rotation, fully-stocked, unmanaged, even-aged stands of Douglas fir may be expected to show an average annual growth per acre of about 350 board feet, Scribner, or about 120 cubic feet (Appendix Figures 1 and 2). A medium potential for minor understory forest products is indicated for soils in this group.

Plant competition affecting Douglas fir reproduction under canopy openings is considered severe. However, the better suited species are not seriously affected. Intensive and costly cultural measures are needed

* Tentative series

to adequately regenerate and grow Douglas fir but such problems are slight for species like cottonwood, red alder, big leaf maple, and Oregon ash.

Potential for Douglas fir Christmas tree production is considered low on this group because the soils are more suited to other tree species.

Woodland Suitability Group No. 19

These are moderately deep and shallow, excessively drained bottomland soils subject to periodic overflow. Surface soils have moderately coarse, coarse and medium textures, and subsoils have coarse textures. Permeability is rapid to very rapid. Annual precipitation is 50 to 70 inches. Mapping units of the following soils are in this group:

Greenwater fine sand
Greenwater fine sandy loam
Greenwater sandy loam
Greenwater gravelly sandy loam
Greenwater loamy sand
Humptulips loam
Humptulips sandy loam
Juno gravelly sandy loam
Juno loamy sand
Newberg loamy fine sand
Pilchuck gravelly sand
Pilchuck loamy fine sand
Pilchuck loamy sand
Pilchuck sand
Rainier sandy loam (see Greenwater)
Toutle gravelly sand
Vogel cobbly loam*

The erosion hazard is rated moderate to severe on this group of soils and is related to periodic overflow. There are no significant limitations on the use of equipment on these soils except during periods of overflow. Windthrow is not a problem. No important potential productivity for either minor understory forest products, or native Douglas fir Christmas trees is recognized. Plant competition for Douglas fir seedlings is a moderate to severe problem during regeneration.

Species most suitable for these soils are cottonwood, red alder and big leaf maple. Douglas fir is suitable on Juno and Greenwater soils. No potential productivity information for any of these suitable woodcrops is currently available.

* Tentative series

Woodland Suitability Group No. 20

These are moderately deep, poorly drained bottomland and terrace basin soils with medium, moderately fine, fine and coarse textured surfaces, and fine textured subsoils with very slow permeability. Annual precipitation is 50 to 100 inches. Mapping units of the following soils are in this group:

Baugh pumicy loam
Bellingham silt loam
Bellingham silty clay loam
Clackamas silty clay
Clackamas silty clay loam
Clackamas gravelly silt loam
Cove silty clay
Cove silty clay loam
Hebo silty clay loam
Hockinson silt loam, shallow*
Koch gravelly loam
Koch gravelly sandy loam
Koch silt loam
Puget clay
Reed clay
Reed silt loam
Reed silty clay loam
Shanghai silt loam*
Shanghai silt loam, clay substratum*
Shanghai clay loam*
Stimson silt loam
Stimson silty clay loam
Tisch loam
Tisch silty clay loam
Tower clay
Tower clay loam
Tower gravelly clay loam
Tower silty clay loam
Towle loam*
Tum Tum clay loam*
Warrenton sand

The soils of this group were originally occupied by water tolerant trees and plants. Most of them were cleared of permanent vegetation and had sub-drainage systems installed to make them suitable for agriculture. The majority of these soils are now under cultivation and little is known about their capacity for producing woodcrops.

* Tentative series

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APPENDIX

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Baugh pumicy loam	20	56
Bear Prairie silt loam	9	43
Belle silt loam	1	33
Bellingham silt loam	20	56
Bellingham silty clay loam	20	56
Bonneville loam	11	45
Bonneville gravelly loam	11	45
Bonneville stony loam	11	45
Brenner silt loam	5	38
Brenner silty clay loam	7	40
Bucoda silty clay loam	13	48
Burlington fine sand	14	49
Camas clay loam	12	47
Camas gravelly loam	11	45
Camas gravelly silt loam	11	45
Carstairs gravelly loam	9	43
Chehalis (Cloquato) loam	3	36
Chehalis silt loam, mottled subsoil	3	36
Chehalis silty clay loam	5	38
Chehalis (Cloquato) silt loam	3	36
Chelatchie loam	9	43
Chemawa shotty loam	12	47
Cinebar gravelly silt loam	12	47
Cinebar silt loam	4	37
Cinebar stony silt loam	4	37
Cispus pumicy sandy loam	14	49
Clackamas silty clay	20	56
Clackamas silty clay loam	20	56
Clackamas gravelly silt loam	20	56
Clatsop silty clay loam	18	53
Cloquallum silt loam, nearly level	10	44
Cloquallum silt loam, rolling	12	47
Cloquallum silty clay loam, nearly level	10	44
Cloquallum silty clay loam, rolling	12	47
Clove silt loam, deep	7	40
Copalis clay loam	2	34
Copalis gravelly silt loam	2	34
Cougar gravelly loamy sand	17	52
Cougar gravelly sandy loam	17	52
Cove silty clay	20	56
Cove silty clay loam	20	56

1/ Including all slope classes mapped for each soil type and phase shown.

Mapping Units 1/	Woodland Suitability Group Number	Narrative Interpretation Page Number
Cowlitz silt loam	5	38
Cowlitz silty clay loam	5	38
Deckerville gravelly loam	18	53
Deckerville gravelly silty clay loam	18	53
Deckerville silt loam	18	53
Deckerville silty clay loam	18	53
Delp fine sandy loam	12	47
Delp loam	12	47
Delphi gravelly loam	6	39
Dobler silt loam	6	39
Dollar silt loam	12	47
Dollar silt loam, deep	12	47
Dollar silt loam, shallow	12	47
Doty silt loam	9	43
Dryad silt loam	7	40
Dryad silty clay loam	7	40
Elma silt loam	12	47
Everson clay loam	18	53
Everson fine sandy loam	18	53
Everson silt loam	18	53
Felida silt loam	12	47
Fiscus silt loam	14	49
Galvin loam	7	40
Galvin silt loam	7	40
Galvin silty clay loam	7	40
Gardner silt loam	3	36
Gee silt loam	12	47
Gee silt loam, very deep	12	47
Germany silt loam	1	33
Glenoma loam	6	39
Glenoma silt loam	6	39
Grande Ronde silt loam	5	38
Grande Ronde silty clay loam	5	38
Greenwater fine sand	19	55
Greenwater fine sandy loam	19	55
Greenwater gravelly sandy loam	19	55
Greenwater loamy sand	19	55
Greenwater sandy loam (formerly Rainier)	19	55
Gridsale loam	2	34
Gumboot silt loam	18	53
Haapa silt loam	6	39
Hazel Dell sandy loam	11	45
Hebo silty clay loam	20	56
Hesson clay loam	12	47
Hesson gravelly clay loam	12	47
Hidden fine gravelly loam	11	45
Hidden loam	11	45

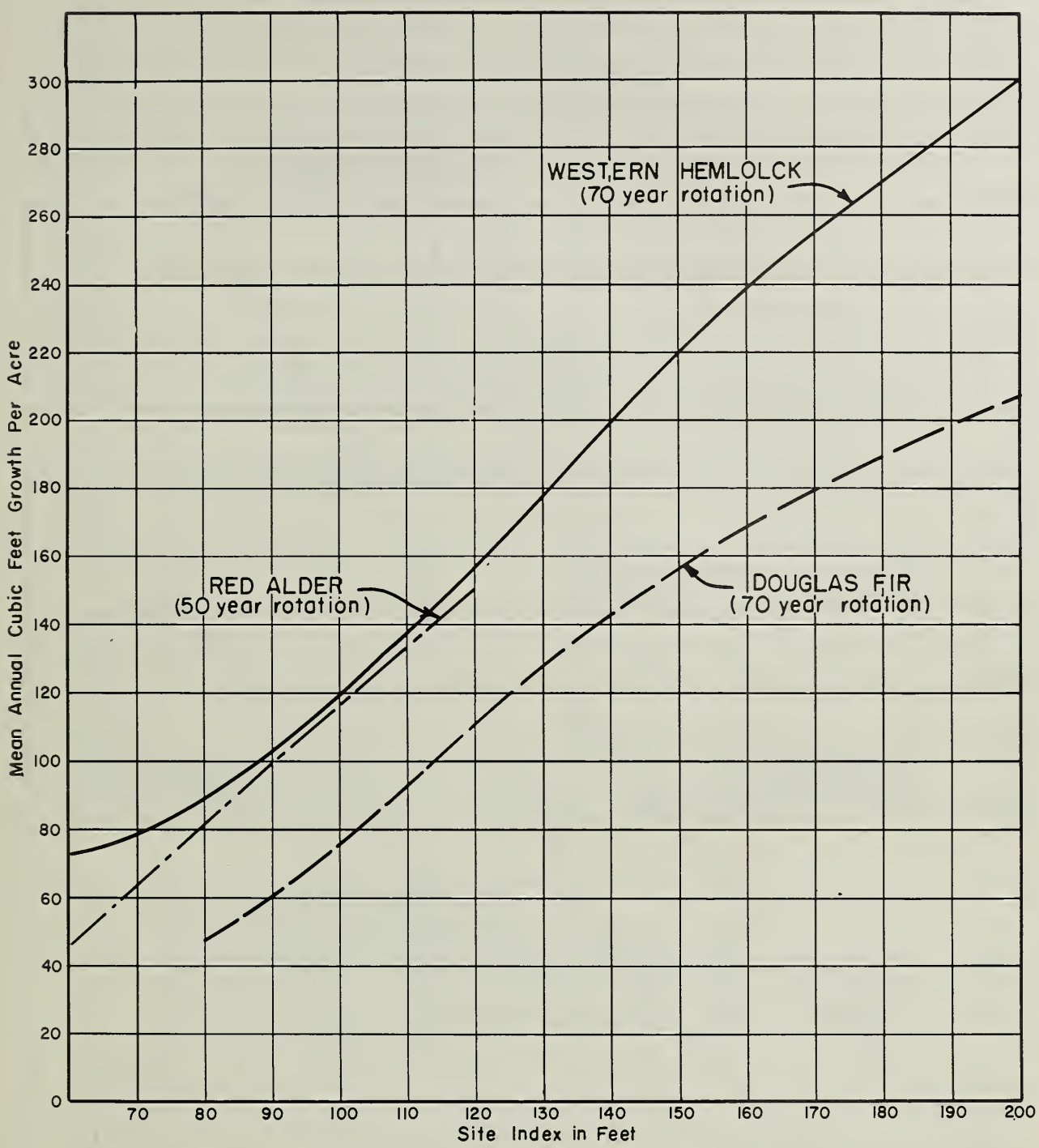
Mapping Units 1/	Woodland Suitability Group Number	Narrative Interpretation Page Number
Hillsboro silt loam	12	47
Hillsboro bouldry silt loam	12	47
Hockinson silt loam	7	40
Hockinson silt loam, shallow	20	56
Hoquiam clay loam	1	33
Hoquiam gravelly loam	1	33
Hoquiam silt loam	1	33
Humptulips loam	19	55
Humptulips sandy loam	19	55
Humptulips silt loam	3	36
Juno loam	3	36
Juno gravelly sandy loam	19	55
Juno loamy sand	19	55
Juno sandy loam	14	49
Kelso silt loam	4	37
Kinney stony silt loam	8	42
Kinney cobbly silt loam	8	42
Klaber silt loam, gravelly subsoil	7	40
Klaber silty clay loam	7	40
Klaber silty clay loam, gravelly subsoil	7	40
Knappa silt loam, high rainfall	1	33
Knappa silt loam, medium rainfall	6	39
Koch gravelly loam	20	56
Koch gravelly sandy loam	20	56
Koch silt loam	20	56
Kopiah silt loam	18	53
Kosmos clay loam	18	53
Lacamas silt loam	18	53
Lacamas silty clay loam	18	53
Larch Mtn. cobbly silt loam	8	42
Larch Mtn. very stony silt loam	8	42
Lauren gravelly loam	11	45
Lauren gravelly loam, moderately shallow	11	45
Lauren loam, moderately shallow	11	45
Lauren loam	11	45
LeBar silt loam	3	36
Lubke silty clay loam (See Scammon)	7	40
Lubke silty clay loam, shallow (See Scammon)	18	53
McCleary gravelly loam	18	53
McKenna gravelly loam	18	53
McKenna gravelly clay loam	18	53
McKenna loam	18	53
Malone gravelly loam	9	43
Martha clay loam	18	53
Martha silt loam	18	53

Mapping Units 1/	Woodland Suitability Group Number	Narrative Interpretation Page Number
Marthen silt loam	12	47
Maytown loam	5	38
Maytown silt loam	5	38
Maytown silty clay loam	5	38
Melbourne silt loam	4	37
Melbourne silty clay loam	13	48
Melbourne stony clay loam	8	42
Melbourne stony loam	8	42
Merwin gravelly silt loam	3	36
Merwin silt loam	3	36
Meskill silt loam	7	40
Meskill silty clay loam	7	40
Moclips clay loam	2	34
Moclips gravelly silt loam	2	34
Mossyrock loam	9	43
Mossyrock silt loam	9	43
Nasel gravelly loam	11	45
Nehalem silt loam	5	38
Nesika clay loam	7	40
Nesika loam	12	47
Nesika gravelly loam	12	47
Newberg fine sandy loam	14	49
Newberg fine sandy loam, moderately deep	14	49
Newberg fine sandy loam, deep	14	49
Newberg loam	3	36
Newberg loam, moderately deep	3	36
Newberg loam, deep	3	36
Newberg loamy fine sand	19	55
Newberg sandy loam	14	49
Newberg silt loam	3	36
Norma clay loam	18	53
Norma loam	18	53
Norma silty clay loam	18	53
Odne silt loam	18	53
Olequa silt loam	6	39
Olympic clay loam	13	48
Olympic cobbly silt loam	4	37
Olympic cobbly silt loam, deep	4	37
Olympic gravelly silt loam	4	37
Olympic silt loam	13	48
Olympic silt loam, deep	4	37
Olympic silty clay loam	13	48
Olympic clay loam, deep	4	37
Olympic stony clay loam	8	42
Olympic stony loam	8	42
Olympic stony silt loam	8	42
Olympic stony silty clay loam	8	42
Onalaska silt loam	7	40

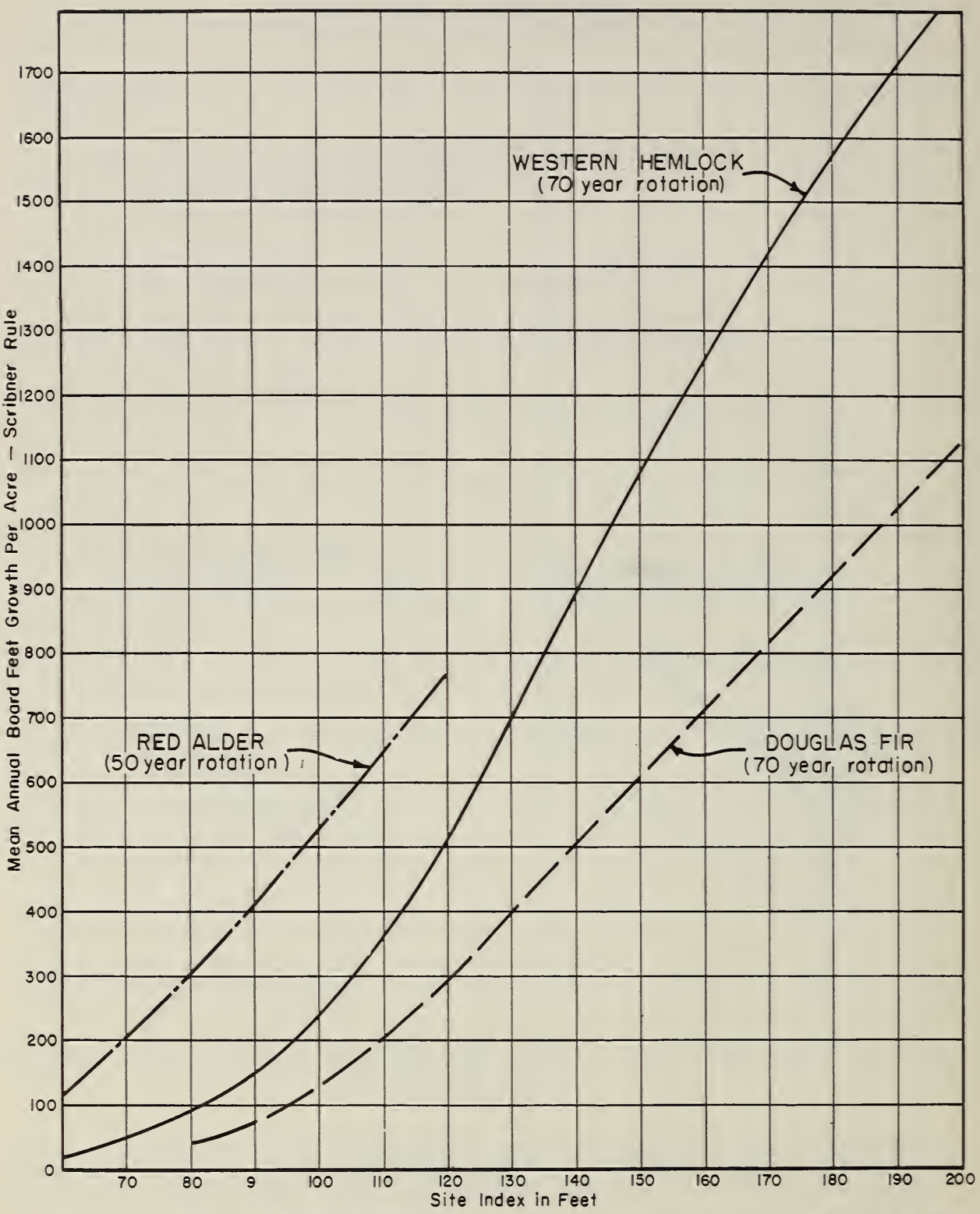
Mapping Units 1/	Woodland Suitability Group Number	Narrative Interpretation Page Number
Onalaska silty clay loam	7	40
Parkdale silt loam	12	47
Peterson clay loam	12	47
Peterson silt loam	12	47
Pilchuck gravelly sand	19	55
Pilchuck loamy fine sand	19	55
Pilchuck loamy sand	19	55
Pilchuck sand	19	55
Pilchuck silt loam	3	36
Powell silt loam	10	44
Prather silty clay loam	4	37
Prindle sandy loam	17	52
Prindle gravelly clay loam	17	52
Puget clay	20	56
Puget silt loam	3	36
Puget silty clay loam	7	40
Puyallup fine sandy loam, deep	3	36
Puyallup fine sandy loam	14	49
Puyallup fine sandy loam, very deep	3	36
Puyallup loam	3	36
Puyallup sandy loam	14	49
Puyallup silt loam	3	36
Puyallup very fine sandy loam	3	36
Quillayute silt loam	9	43
Rainier sandy loam (See Greenwater)	19	55
Reed clay	20	56
Reed silt loam	20	56
Reed silty clay loam	20	56
Riffe fine sandy loam	14	49
Riffe loam	14	49
Riffe sandy loam	14	49
Roper cobbly loam	11	45
Roper gravelly loam	11	45
Roper stony loam	11	45
St. Helens pumicy sandy loam	15	50
St. Martins clay loam	16	51
St. Martins stony clay loam	16	51
Salkum clay loam, deep	4	37
Salkum silt loam	12	47
Salkum silty clay loam, shallow	10	44
Salkum silty clay loam, moderately deep	10	44
Salkum silty clay loam and clay loam	12	47
Salkum silty clay loam, deep	4	37
Salkum very stony silty clay loam	8	42
Salkum very stony silty clay loam, moderately shallow	8	42

Mapping Units 1/	Woodland Suitability Group Number	Narrative Interpretation Page Number
Sara silt loam	10	44
Sara silt loam, moderately shallow	10	44
Sauvie silt loam	5	38
Sauvie silt loam, fine sandy loam subsoil	5	38
Sauvie silty clay loam	5	38
Scammon silt loam	7	40
Scammon silty clay loam	7	40
Scammon silty clay loam, shallow	18	53
Schooley loam	18	53
Schooley silt loam	18	53
Seaquest clay loam	4	37
Shanghai silt loam	20	56
Shanghai silt loam, clay substratum	20	56
Shanghai clay loam	20	56
Sifton gravelly loam	11	45
Sifton gravelly loam, shallow	11	45
Siler fine sandy loam	3	36
Siler silt loam	3	36
Skamania silt loam	8	42
Skamania very fine sandy loam	8	42
Skamokawa silt loam	6	39
Skamokawa silty clay loam	6	39
Stabler cobbly loam	15	50
Stabler loam	15	50
Stabler silt loam	15	50
Stabler shotty loam	15	50
Stevenson clay loam	8	42
Stevenson gravelly clay (silt) loam	8	42
Stevenson stony clay loam	8	42
Stevenson stony loam	8	42
Stimson silt loam	20	56
Stimson silty clay loam	20	56
Sultan silt loam	3	36
Tebo gravelly loam	1	33
Tebo loam	1	33
Tebo clay loam	1	33
Tebo stony clay loam	1	33
Tillamook silt loam	9	43
Tisch loam	20	56
Tisch silty clay loam	20	56
Toutle gravelly sand	19	56
Toutle loamy fine sand	14	49
Toutle loamy sand	14	49
Toutle sandy loam	14	49
Tower clay	20	56
Tower clay loam	20	56
Tower gravelly clay loam	20	56
Tower silty clay loam	20	56

Mapping Units 1/	Woodland Suitability Group Number	Narrative Interpretation Page Number
Towle loam	20	56
Tum Tum clay loam	20	56
Vader loam	1	33
Vancouver loam	3	36
Viola clay loam	7	40
Viola cobbly silty clay loam	18	53
Viola silt loam	7	40
Viola silty clay loam	7	40
Viola stony silty clay loam	18	53
Vogel cobbly loam	19	55
Wadell loam	4	37
Wadell silty clay loam	4	37
Wadell stony silty clay loam	4	37
Wapato clay loam	18	53
Wapato silt loam	18	53
Wapato silty clay loam	18	53
Warrenton sand	20	56
Washougal loam	14	49
Washougal gravelly loam	14	49
Washougal silt loam	14	49
Washougal gravelly fine sandy loam	14	49
Westport sand	14	49
Wilkeson silt loam	13	48
Willamette silt loam	4	37
Wind River gravelly loam	11	45
Wind River loam	14	49
Wind River silt loam	14	49
Winlock silt loam	4	37
Winlock silty clay loam	4	37
Winston gravelly loam	11	45
Winston gravelly sandy loam	11	45
Winston loam	11	45
Winston silt loam	11	45
Wynoochee silty clay loam	18	53
Yacolt silt loam	12	47
Yacolt cobbly silt loam	8	42
Yacolt stony silt loam	8	42



APPENDIX FIGURE I: Mean annual cubic feet growth per acre (DOUGLAS FIR- from U.S.D.A. Tech. Bull. No. 201, Rev. Table 3; WESTERN HEMLOCK – from U.S.D.A. Tech. Bull. No. 544, Table 28; RED ALDER - from U.S.D.A. – Forest Service, PNW Forest and Range Exp. Sta., Research Paper No. 36, Table II)



APPENDIX FIGURE 2. Mean annual board feet growth per acre (DOUGLAS FIR-from U.S.D.A. Tech. Bull. No. 201., Rev. Table 4; WESTERN HEMLOCK – from U.S.D.A. Tech. Bull. No. 544, Table 30; RED ALDER – from U.S.D.A.–Forest Service, PNW Forest and Range Exp. Sta., Research Paper No.36, Table 13).

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Astoria silty clay loam	C	1	Grays Harbor County	270°		13		Well	200	65"	41"		116	48	170
Astoria silty clay loam	F	2	Grays Harbor County	225°		65		Well	200	65	41		116	50	166
Astoria silty clay loam	C	3	Grays Harbor County	315°		15		Well	200	65	41		145	58	190
Astoria silty clay loam	C	4	Grays Harbor County	0°		15		Well	200	65	41		125	45	192
Astoria silty clay loam	D	5	Grays Harbor County	315°		28		Well	200	65	41		123	43	196
Astoria silty clay loam	D	7	Grays Harbor County	270°		20		Well	200	65	41		89	35	168
Astoria silty clay loam	E	8	Grays Harbor County	180°		33		Well	200	65	41		108	43	172
Astoria silty clay loam	F	9	Grays Harbor County	315°		60		Well	200	65	41		112	39	192
Astoria silty clay loam	E	10	Grays Harbor County	45°		40		Well	200	65	41		117	38	205
Astoria silty clay loam	C	15	Grays Harbor County	225°		12		Well	200	65	41		98	40	162
Astoria silty clay loam	C	16	Grays Harbor County	180°		12		Well	200	65	41		105	40	175
Astoria silty clay loam	D	17	Grays Harbor County	270°		25		Well	200	65	41		107	43	170
Astoria silty clay loam	C	18	Grays Harbor County	180°		13		Well	200	65	41		117	46	178
Astoria silty clay loam	D	19	Grays Harbor County	270°		25		Well	200	65	41		123	47	184
Astoria silty clay loam	F	20	Grays Harbor County	270°		62		Well	200	65	41		121	47	186
Astoria silty clay loam	D	21	Grays Harbor County	225°		25		Well	200	65	41		120	51	170
Astoria silty clay loam	F	22	Grays Harbor County	45°		75		Well	200	65	41		130	47	195
Astoria silty clay loam	D	23	Grays Harbor County	0°		28		Well	200	65	41		134	47	202
Astoria silty clay loam	D	25	Grays Harbor County	270°		25		Well	200	65	41		105	39	178
Astoria silty clay loam	C	28	Grays Harbor County	90°		15		Well	200	65	41		130	48	192
Astoria silty clay loam	A	29	Grays Harbor County			2		Well	200	65	41		108	39	182
Astoria silty clay loam	A	30	Grays Harbor County			2		Well	200	65	41		118	43	188
Astoria silty clay loam	C	31	Grays Harbor County					Well	200	65	41		120	47	180
Astoria silty clay loam	E	41	Grays Harbor County	115°		43		Well	200	65	41				180
Astoria silty clay loam	C	42	Grays Harbor County			10		Well	200	65	41				180
Astoria silty clay loam	F	47	Grays Harbor County	270°		52		Well	200	65	41		130	48	192
Astoria silty clay loam	C	70	Cowlitz County	45°		12		Well	200	65	41		95	44	148
Astoria silty clay loam	A	129	Lewis County			1		Well	200	65	41		125	50	180
Astoria silty clay loam	E	13	Pacific County	315°	M	40	280	Well	200	110	69	6	96	36	176
Astoria silty clay loam	E	6	Grays Harbor County	225°		43	200	Well	200	80	57	7	125	61	260
Astoria silty clay loam	D	9	Pacific County	135°	ML	25	120	Well	200	110	69	5	133	51	190
Astoria silty clay loam	C	10	Pacific County	0°	U	20	200	Well	200	110	69	7	83	33	165
Astoria silty clay loam	B	19	Pacific County		M	7	350	Well	200	110	69	4	187	100	168
Astoria silty clay loam	D	7	Pacific County	0°	L	25	250	Well	200	110	69	5	148	55	200
Astoria silty clay loam	D	14	Pacific County	225°	M	30	280	Well	200	110	69	6	90	32	184
Astoria silty clay loam	C	17	Pacific County		M	15	340	Well	200	110	69	6	121	45	188
Bear Prairie silt loam	A	201	Clark County		F	3	1400	Well	158	80	50	5	87	42	140
Bear Prairie silt loam	B	128	Clark County	270°	M	5	1150	Well	165	70	44	5	124	70	146
Bear Prairie silt loam	D	114	Skamania County	180°	M	20	1200	Well	160	70	44	6	53	26	140
Bear Prairie silt loam	A	95	Skamania County			1	1160	Well	165	70	44	8	60	30	130
Bear Prairie silt loam	A	94	Clark County		Top	2	1120	Well	170	70	44	7	103	49	149
Belle silt loam	D	9	Grays Harbor County	90°	L	18	150	Mod. Well	218	70	44	6	152	57	196
Chehalis silty clay loam	A	121	Lewis County			1	200	Well	233	46	30		135	58	178
Chehalis silty clay loam	A	75	Lewis County			2	200	Well	233	46	30		120	51	170
Chemawa shotty loam	C	56	Skamania County	260°	M	11	700	Well	205	38	23	5	121	65	149
Chemawa shotty loam		8	Skamania County				1680	Well	160	45	28	6	131	68	154
Chemawa shotty loam	C	26	Skamania County	90°	M	15	1020	Well	188	45	28	5	104	47	155
Chemawa shotty loam	A	60	Skamania County	240°	Top	2	900	Well	192	55	35	5	98	41	160
Chemawa shotty loam	A	61	Skamania County		L	1	600	Well	210	60	38	5	119	56	159
Cinebar silt loam	A	83	Cowlitz County		L	1		Well	170	100	63	5	77	28	183
Cinebar silt loam	B	84	Cowlitz County			4		Well	180	70	43	5	130	48	193
Cinebar silt loam	E	123	Cowlitz County	180°	M	38	540	Well	180	70	43	6	112	43	179
Cinebar silt loam	D	22	Lewis County	45°		25		Well	190	50	31		95	34	184
Cinebar silt loam	C	23	Lewis County	180°		12		Well	190	50	31		95	34	184
Cinebar silt loam	B	26	Lewis County	270°		5		Well	190	50	31		125	49	183
Cinebar silt loam	B	27	Lewis County	135°		6		Well	190	50	31		140	52	197

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Cinebar silt loam		28	Lewis County			1		Well	190	50	31		115	40	191
Cinebar silt loam	D	50	Lewis County	0°		20		Well	190	50	31		135	62	171
Cinebar silt loam	B	51	Lewis County	315°		4		Well	190	50	31		125	53	172
Cinebar silt loam	D	52	Lewis County	180°		25		Well	190	50	31		110	44	172
Cinebar silt loam	C	58	Lewis County	45°		10		Well	190	50	31		120	47	180
Cinebar silt loam	C	201	Lewis County	0°	U	12		Well	190	50	31	5	96	36	176
Cinebar silt loam		200	Lewis County					Well							190
Cinebar silt loam	C	86	Clark County	0°	L	10	500	Well	180	60	37	5	52	22	173
Cinebar silt loam	D	109	Clark County	225°	U	20	700	Well	175	60	37	5	81	32	166
Cinebar silt loam	A	107	Clark County		U	2	700	Well	175	70	43	5	95	38	166
Cinebar silt loam	B	119	Clark County	270°	Top	4	660	Well	175	70	43	6	87	34	168
Cinebar silt loam	A	29	Lewis County			2		Well	190	50	31		130	56	174
Cinebar silt loam	A	30	Lewis County			2		Well	190	50	31		130	56	174
Cinebar silt loam	D	107	Cowlitz County	90°	M	17	1000	Well	165	85	54	5	161	74	186
Cinebar stony silt loam	C	121	Clark County	0°	U	12	820	Well	170	65	40	6	111	41	182
Cinebar stony silt loam	C	120	Clark County	0°	U	14	700	Well	175	60	37	6	105	39	177
Cinebar stony silt loam	B	110	Clark County	0°	U	5	720	Well	175	60	37	5	113	44	177
Cinebar stony silt loam	B	57	Clark County	270°	U	5	800	Well	170	65	40	6	127	48	188
Cinebar stony silt loam	D	25	Lewis County	45°		18		Well	190	50	31		125	44	196
Cinebar stony silt loam	E	55	Lewis County	90°		43		Well					108	47	162
Cinebar stony silt loam	D	56	Lewis County	90°		30		Well	190	50	31		75	27	188
Cinebar stony silt loam	E	57	Lewis County	90°		40		Well					105	45	162
Cinebar stony silt loam		02	Lewis County												176
Cloquallum silt loam, nearly levol	C	203	Mason County	290°	M	8	120	Imperfect	200	75	47	5	92	57	123
Clove silt loam	C	7	Cowlitz County	90°	L	10	300	Imperfect	200	60	37	5	96	40	160
Clove silt loam	C	6	Cowlitz County		Top	10	250	Imperfect	200	60	37	6	99	40	165
Clove silt loam	C	4	Cowlitz County	225°	M	14	800	Imperfect	185	65	40	6	133	60	171
Clove silt loam	D	34	Cowlitz County	225°	U	20	500	Imperfect	190	60	37	4	116	54	158
Clove silt loam	B	79	Cowlitz County		L	4	30	Imperfect	225	55	35	5	78	31	165
Clove silt loam	C	77	Cowlitz County		L	10	300	Imperfect	200	60	37	6	118	50	168
Clove silt loam	C	11	Cowlitz County	315°	M	14	650	Imperfect	190	65	40	6	104	41	170
Clove silt loam	B	21	Cowlitz County	0°	U	6	400	Imperfect	195	60	40	6	80	31	170
Clove silt loam	E	27	Cowlitz County	270°	M	35	700	Imperfect	190	55	35	5	97	40	161
Clove silt loam	B	24	Cowlitz County	270°	M	8	300	Imperfect	200	50	35	6	105	45	161
Clove silt loam	C	23	Cowlitz County	270°	U	13	900	Imperfect	185	55	35	6	102	43	162
Clove silt loam	B	19	Cowlitz County	270°	U	5	400	Imperfect	195	60	37	6	100	43	159
Delp loam	C	16	Clark County	180°	U	10	250	Imperfect	200	40	25	9	87	37	156
Delp loam	A	59	Clark County			3	175	Imperfect	225	60	38	5	86	37	154
Delp loam	B	14	Clark County	90°	M	5	200	Imperfect	223	40	25	4	87	39	149
Delp loam	A	13	Clark County			2	200	Imperfect	223	40	25	6	91	40	152
Delp loam	A	18	Clark County			1	250	Imperfect	200	45	28	5	78	31	165
Delp loam	B	49	Clark County	135°	L	7		Imperfect	200	40	25	7	104	46	157
Delp loam	A	46	Clark County			1	275	Imperfect	200	45	28	6	103	44	161
Delp loam	A	48	Clark County			1	225	Imperfect	210	40	25	8	89	38	155
Delp loam	A	35	Clark County			1	250	Imperfect	200	40+	25	6	122	66	149
Delp loam	A	98	Clark County			2	280	Imperfect	220	60	38	7	94	42	152
Dobler silt loam	B	X	Clark County	110°	M	7	750	Well	161	55	35	5	119	52	166
Dobler silt loam	B	129	Clark County	180°	M	4	600	Well	170	50	32	5	92	38	160
Dobler silt loam	C	130	Clark County	270°	M	10	660	Well	167	55	35	6	101	39	171
Dobler silt loam	A	81	Clark County	90°	U	3	550	Well	173	45	30	6	126	57	167
Dobler silt loam	C	111	Clark County	270°		12	600	Well	170	50	32	5	105	41	172
Dobler silt loam	B	56	Clark County	270°	U	5	700	Well	164	60	38	7	106	42	172
Dobler silt loam	B	2	Cowlitz County	180°	M	4	800	Well	158	60	38	6	80	30	174

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Dollar loam	A	36	Clark County			1	275	Poor	235	50	32	5	106	48	155
Dollar loam	A	89	Clark County			1	260	Poor	235	50	32	7	61	28	146
Dollar loam	A	37	Clark County		Top	2	275	Poor	235	45	28	5	62	29	142
Dollar loam	B	79	Clark County			4	300	Poor	235	50	32	7	81	37	145
Dollar loam	A	87	Clark County			1	300	Poor	235	40	25	7	86	36	158
Dollar loam	B	118	Clark County	270°	M	8	300	Poor	235	40	25	5	89	35	168
Felida silt loam	F	126	Clark County	90°	M	55	160	Well	250	40	25	6	93	39	159
Felida silt loam	A	60	Clark County			3	200	Well	250	40	25	7	86	36	158
Felida silt loam	A	50	Clark County			1	200	Well	250	40	25	6	76	33	152
Felida silt loam	C	75	Clark County	90°	U	10	220	Well	250	40	25	6	124	59	161
Felida silt loam	C	66	Clark County	0°	M	15	100	Well	290	40	25	6	87	36	160
Felida silt loam	B	103	Clark County	90°	M	5	200	Well	250	40	25	5	104	48	153
Felida silt loam	A	21	Clark County		L	1	225	Well	250	40	25	4	124	60	160
Gee silt loam	A	76	Clark County			1	260	Mod. Well	235	40	25	7	96	45	147
Gee silt loam	A	71	Clark County			1	360	Mod. Well	230	45	28	7	87	38	152
Gee silt loam	B	77	Clark County	0°	U	4	300	Mod. Well	235	45	28	7	88	41	144
Gee silt loam	D	54	Clark County	270°	L	18	300	Mod. Well	235	45	28	8	83	36	152
Gee silt loam	A	72	Clark County	0°	U	2		Mod. Well		50	32	8	81	35	152
Gee silt loam	A	74	Clark County	270°		3	300	Mod. Well	235	40	25	8	92	40	153
Gee silt loam	B	68	Clark County	225°	U	5	200	Mod. Well	241	40	25	8	67	29	152
Gee silt loam	C	45	Clark County	90°	M	14	300	Mod. Well	235	40	25	5	104	46	157
Gee silt loam	A	65	Clark County		L	1	180	Mod. Well	241	40	25	7	100	42	162
Gee silt loam	F	55	Cowlitz County	225°	L	60	130	Mod. Well	245	60	38	5	119	55	161
Gee silt loam	B	43	Clark County	270°	L	6	175	Mod. Well	244	40	25	7	84	35	160
Gee silt loam	D	99	Clark County	0°	M	25	150	Mod. Well	244	40	25	7	95	47	142
Gee silt loam	D	102	Cowlitz County	315°	M	20	200	Mod. Well	241	45	28	5	90	36	166
Germany silt loam	C	45	Cowlitz County	270°	L	15	400	Well	220	64	40	6	89	32	182
Germany silt loam	D	46	Cowlitz County	180°	U	23	400	Well	220	64	40	5	98	35	183
Germany silt loam	D	51	Cowlitz County	0°	L	30	200	Well	226	60	38	6	145	51	206
Germany silt loam	C	52	Clark County	180°	Top	10	150	Well	228	60	38	5	116	57	192
Germany silt loam	C	53	Cowlitz County	0°	U	10	100	Well	230	60	38	6	130	51	184
Germany silt loam	D	56	Cowlitz County	270°	L	23	80	Well	232	60	38	5	134	56	180
Germany silt loam	B	57	Cowlitz County		Top	4	200	Well	226	60	38	4	147	55	199
Germany silt loam	D	58	Cowlitz County	135°	M	30	250	Well	224	60	38	6	141	52	198
Germany silt loam	C	64	Cowlitz County	0°	Top	10	500	Well	217	65	42	5	101	33	202
Germany silt loam	B	61	Cowlitz County	225°	L	6	240	Well	224	60	38	7	112	41	183
Haapa silt loam	A	LD	Clark County			1	420	Well	211	52	33	5	107	47	160
Haapa silt loam	A	100C	Clark County			1	400	Well	222	50	32	6	108	45	166
Haapa silt loam	B	51	Clark County	225°	M	7	425	Well	211	52	33	6	108	48	158
Haapa silt loam	A	63	Clark County			3	440	Well	210	55	35	6	103	42	166
Haapa silt loam	A	70	Clark County			1	400	Well	212	60	38	6	96	38	168
Haapa silt loam	E	48	Clark County	135°	M	45	200	Well	219	50	32	5	97	40	162
Haapa silt loam	C	15	Cowlitz County	225°	M	10	160	Well	220	45	28	5	99	43	157
Hesson clay loam	B	19	Clark County	180°	U	5	475	Well	211	55	35	6	77	33	152
Hesson clay loam	A	106	Clark County			2	340	Well	215	50	32	5	120	60	154
Hesson clay loam	A	29	Clark County		L	1	375	Well	214	50	32	5	95	44	148
Hesson clay loam	B	47	Clark County	180°	U	6	375	Well	214	50	32	7	67	29	151
Hesson clay loam	A	88	Clark County		L	1	350	Well	215	50	32	8	77	33	154
Hesson clay loam	C	20	Clark County	270°	M	10	400	Well	213	50	32	3	95	41	155
Hesson clay loam	C	23	Clark County	225°	U	15	550	Well	205	50	32	7	84	35	158
Hidden loam	A	124	Clark County			3	220	Well	250	45	28	5	85	42	137

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Kelso silt loam	E	38	Cowlitz County	235°	L	33	150	Well	220	50	32	4	144	63	180
Kelso silt loam	B	82	Cowlitz County			5	80	Well	222	50	32	5	133	53	184
Kelso silt loam	B	81	Cowlitz County	0°	L	6	100	Well	222	50	32	5	106	42	172
Kinney cobbly silt loam	B	82	Clark County	180°	M	6	1600	Well	160	60	40	9	94	48	138
Klaber silty clay loam	A	136	Lewis County		U	1	170	Poor	233	46	29		120	55	163
Klaber silty clay loam	A	137	Lewis County		U	1	210	Poor	233	48	30		112	54	153
Klaber silty clay loam	A	138	Lewis County		U	1	210	Poor	233	48	30		118	54	162
Klaber silty clay loam	A	139	Lewis County		U	2	215	Poor	230	50	32		115	57	152
Klaber silty clay loam	A	140	Lewis County		U	1	215	Poor	230	50	32		105	47	157
Klaber silty clay loam	A	75	Cowlitz County		U	2	700	Poor	218	55	35	6	94	39	160
Knappa silt loam)	F	12	Pacific County	0°	M	60	350	Well	271	110	55	6	136	50	196
Knappa silt loam, high	A	4	Wahkiakum County		U	2	175	Well	235	85	48	5	127	50	180
Knappa silt loam, rainfall	B	5	Wahkiakum County	175°	U	7	275	Well	232	90	50	5	69	25	190
Knappa silt loam)	B	70	Cowlitz County	180°	U	7	300	Well	230	85	48	5	114	42	184
Knappa silt loam (	A	42	Cowlitz County		L	3	700	Well	218	70	44	5	103	41	169
Knappa silt loam (medium	D	43	Cowlitz County	270°	M	30	600	Well	221	65	41	5	109	43	173
Knappa silt loam (rainfall	B	92	Cowlitz County			4	700	Well	218	70	44	6	81	33	160
Knappa silt loam (	A	66	Wahkiakum County	270°		3	700	Well	218	70	44	6	79	31	168
Knappa silt loam) high	C	93	Wahkiakum County	0°	U	10	800	Well	215	72	45	6	83	33	165
Knappa silt loam) rainfall	A	12	Wahkiakum County	0°	M	2	800	Well	215	72	45	5	92	36	162
Knappa silt loam (	B	59	Cowlitz County	270°	L	4	250	Well	235	65	41	4	81	30	176
Knappa silt loam (medium	C	60	Cowlitz County	270°	M	9	250	Well	235	65	41	3	78	27	195
Knappa silt loam (rainfall		64	Cowlitz County	1°	U	10	500	Well	224	65	41		100	33	200
Lacamas silty clay loam	A	60	Lewis County		L	1		Poor	360	48	30		65	34	126
Lacamas silty clay loam	A	186	Lewis County		L	1		Poor	340	48	30		85	50	122
Lauren loam, deep	B	7	Clark County	0°	M	4	225	Somewhat ex.	272	45	28	7	105	61	134
Lauren loam, deep	A	4	Clark County	0°	L	3	275	Somewhat ex.	268	45	28	3	98	46	150
Lauren loam, deep	A	11	Clark County	180°	M	3	250	Somewhat ex.	268	45	28	8	91	44	142
Lauren loam, deep	B	3	Clark County	180°	M	5	100	Somewhat ex.	280	45	28	4	99	51	140
Lauren loam, deep	A	202	Clark County		M	1	200	Somewhat ex.	270	45	28	6	84	40	140
Lauren loam, deep	B	15	Clark County	270°	M	5	200	Somewhat ex.	270	40	25	4	61	30	132
Lauren loam, deep	A	2	Clark County			1	300	Somewhat ex.	267	45	28	4	84	44	131
Lauren loam, deep	A	8	Clark County		L	1	200	Somewhat ex.	270	40	25	5	94	42	152
Lauren loam, deep	B	125	Clark County	180°	U	4	200	Somewhat ex.	270	40	25	6	62	30	135
Lauren gravelly loam	A	12	Clark County		M	1	200	Somewhat ex.	270	40	25	10	71	39	122
Lauren gravelly loam	A	1	Clark County		M	1	300	Somewhat ex.	267	45	28	7	111	72	128
Lauren gravelly loam	B	9	Clark County	0°	L	4	250	Somewhat ex.	268	45	28	8	56	31	118
Lauren gravelly loam	A	10	Clark County			2	225	Somewhat ex.	272	45	25	8	71	40	119
Lauren gravelly loam	A	5	Clark County			2	300	Somewhat ex.	267	45	28	5	70	41	115
Lauren gravelly loam	A	6	Clark County			1	300	Somewhat ex.	267	45	28	7	94	63	118
Malone gravelly loam	A	1	Grays Harbor County			1	100	Well	235	70	46	6	96	47	143
Martha clay loam	A	2	Skamania County	135°		2	1000	Poor	173	90	57	4	95	55	128
Martha clay loam	A	2b	Skamania County	135°		2	1000	Poor	173	90	57	5	82	43	130
Melbourne silty clay loam	C	37	Cowlitz County	270°	M	10	400	Well	215	55	35	6	96	36	176
Melbourne silty clay loam	C	40	Cowlitz County	270°	L	15	300	Well	218	55	35	5	112	44	175
Melbourne silty clay loam	C	63	Cowlitz County	270°	M	10	350	Well	217	55	35	5	69	28	163
Melbourne silty clay loam	D	74	Cowlitz County	270°	M	25	400	Well	215	55	35	5	72	29	163
Melbourne silty clay loam	E	28	Cowlitz County	180°	M	32	250	Well	225	50	32	5	109	49	160
Melbourne silty clay loam	E	39	Cowlitz County	225°	M	35	300	Well	218	50	32	6	113	54	154

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Melbourne silty clay loam	C	62	Cowlitz County	180°	L	10	200	Well	230	60	38	5	96	41	157
Melbourne silty clay loam	C	02	Lewis County	315°	M	15	300	Well	215	70	44	5	123	62	156
Melbourne silty clay loam	C	153	Lewis County	0°		12		Well		65	41		112	47	167
Melbourne silty clay loam	D	154	Lewis County	180°		18		Well		65	41		110	50	158
Melbourne silty clay loam	E	155	Lewis County	135°		35		Well		65	41		112	52	158
Melbourne silty clay loam	A	157	Lewis County	0°		2		Well		65	41		108	49	158
Melbourne silty clay loam	C	171	Lewis County	180°		15		Well		65	41		85	39	145
Melbourne silty clay loam	E	187	Lewis County	180°		34	500	Well	210	70	44		128	69	152
Melbourne silty clay loam	D	188	Lewis County	225°		27	350	Well	215	65	41		98	49	142
Melbourne silty clay loam	E	191	Lewis County	45°		40	650	Well	200	70	44		130	74	148
Melbourne silty clay loam	E	1	Lewis County	270°		48	300	Well	218	65	41		112	63	140
Melbourne silty clay loam	E	65	Lewis County	180°		32	450	Well	210	70	44		100	39	170
Melbourne silty clay loam	B	67	Lewis County	0°		5	400	Well	210	65	41		110	50	157
Melbourne silty clay loam	B	68	Lewis County	0°		7	600	Well	200	65	41		128	65	157
Melbourne silty clay loam	D	80	Lewis County	135°		28	450	Well	210	70	44		65	26	172
Melbourne silty clay loam	D	81	Lewis County	45°		17	350	Well	215	65	41		132	61	168
Melbourne silty clay loam	E	82	Lewis County	45°		36	350	Well	215	65	41		137	62	174
Melbourne silty clay loam	D	83	Lewis County	315°		18	500	Well	210	70	44		105	45	162
Melbourne silty clay loam	E	84	Lewis County	180°		36	650	Well	195	65	41		130	67	158
Melbourne silty clay loam	D	87	Lewis County	180°		25	500	Well	210	50	32		100	46	152
Melbourne silty clay loam	E	88	Lewis County	0°		45	500	Well	210	50	32		110	46	168
Melbourne silty clay loam	C	115	Lewis County	0°		12	500	Well	210	50	32		115	53	158
Melbourne silty clay loam	D	116	Lewis County	0°		28	500	Well	210	50	32		105	53	145
Melbourne silty clay loam	D	130	Lewis County	180°		16	250	Well	225	45	28		108	52	152
Melbourne silty clay loam	E	131	Lewis County	45°		35	250	Well	225	45	28		126	54	172
Melbourne silty clay loam	D	141	Lewis County	225°		25	400	Well	210	50	32		105	51	148
Melbourne silty clay loam	C	147	Lewis County	90°		10	400	Well	210	50	32		115	50	164
Melbourne silty clay loam	D	148	Lewis County	270°		18	400	Well	210	50	32		105	53	145
Melbourne silty clay loam	B	149	Lewis County	180°		5	400	Well	210	50	32		120	52	168
Melbourne silty clay loam	D	150	Lewis County	45°		20		Well					125	52	175
Melbourne silty clay loam	D	151	Lewis County	270°		17	400	Well	210	50	32		110	55	148
Melbourne silty clay loam	C	152	Lewis County	270°		13	400	Well	210	50	32		102	52	143
Meskill silty clay loam	F	64	Lewis County	180°		62	250	Well	225	45	28		100	48	148
Meskill silty clay loam	F	66	Lewis County	180°		65	300	Well	218	45	28		115	59	149
Meskill silty clay loam		143	Lewis County			1	500	Well	210	48	30		102	50	146
Meskill silty clay loam		144	Lewis County			1	500	Well	210	48	30		95	50	136
Meskill silty clay loam		145	Lewis County			1	500	Well	210	48	30		105	53	145
Meskill silty clay loam	C	68	Lewis County	180°	L	15	400	Well	210	45	28	5	68	32	140
Meskill silty clay loam	D	69	Lewis County	180°	L	28	300	Well	218	45	28	4	108	56	144
Odne silt loam	A	96	Clark County		L	1	200	Poor	230	45	28	7	61	33	122
Olequa silt loam	F	70	Lewis County	280°	L	55	150	Well	230	45	28	5	112	55	151
Olequa silt loam	C	71	Cowlitz County	60°	M	15	110	Well	230	45	28	5	124	59	161
Olequa silt loam	F	122	Lewis County	0°	U	55	200	Well	230	45	28		135	63	168
Olequa silt loam		135	Lewis County				220	Well	230	45	28		117	56	158
Olympic clay loam, deep	C	42	Thurston County	105°	M	14	263	Well	210	45	28	5	130	58	171
Olympic clay loam, deep	F	45	Thurston County	345°	L	54	650	Well	180	50	32	5	110	44	172
Olympic clay loam, deep	C	105	Cowlitz County	225°	M	14	1200	Well	200	50	32	5	130	59	169
Olympic clay loam, deep	D	71	Lewis County	315°		27	400	Well	225	45	28		115	45	178
Olympic clay loam, deep	F	126	Lewis County	90°		70	400	Well	225	45	28		122	50	176
Olympic clay loam, deep	A	30	Clark County		L	1	500	Well	210	50	32	6	120	51	170
Olympic clay loam, deep	E	117	Lewis County	90°		38	600	Well	220				123	53	170
Olympic clay loam, deep	E	180	Lewis County	45°		33		Well					122	52	170
Olympic clay loam, deep	D	18	Cowlitz County	180°	M	25	700	Well	220	55	35	5	155	82	169
Olympic clay loam, deep	C	87	Cowlitz County	0°		10	400	Well	225	55	35	5	87	34	168
Olympic clay loam, deep		89	Cowlitz County	0°		10	400	Well	225	55	35		93	36	171

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Olympic clay loam and silty clay loam	C	72	Cowlitz County	280°	M	10	460	Well	223	60	38	6	86	39	147
Olympic clay loam and silty clay loam	D	17	Cowlitz County	180°	M	25	300	Well	228	60	38	6	100	46	151
Olympic clay loam and silty clay loam	C	3	Cowlitz County	180°	M	10	1075	Well	205	60	38	6	99	41	162
Olympic clay loam and silty clay loam	F	73	Cowlitz County	75°	M	95	150	Well	230	60	28	5	126	61	161
Olympic clay loam and silty clay loam	D	161	Cowlitz County	225°		18		Well					82	37	147
Olympic clay loam and silty clay loam	D	162	Cowlitz County	180°		18		Well					85	38	148
Olympic clay loam and silty clay loam	E	166	Cowlitz County	0°		35		Well					112	54	153
Olympic clay loam and silty clay loam	C	167	Cowlitz County	270°		11		Well					106	54	145
Olympic clay loam and silty clay loam	C	168	Cowlitz County	270°		15		Well					106	52	148
Olympic clay loam and silty clay loam	B	169	Cowlitz County	270°		6		Well					106	54	145
Olympic clay loam and silty clay loam	C	172	Cowlitz County	0°		15		Well					125	59	162
Olympic clay loam and silty clay loam	C	173	Cowlitz County	180°		10		Well					86	36	158
Olympic clay loam and silty clay loam	C	174	Cowlitz County	135°		10		Well					118	54	162
Olympic clay loam and silty clay loam	C	103	Cowlitz County	315°	M	10	500	Well		45		5	89	37	160
Olympic clay loam and silty clay loam	B	91	Clark County	90°	M	8	900	Well	215	55	35	7	107	46	162
Olympic clay loam and silty clay loam	D	24	Clark County	0°	M	30	600	Well	225	50	32	6	97	42	157
Olympic clay loam and silty clay loam	B	62	Clark County	135°	U	4	640	Well	225	55	35	7	74	32	152
Olympic clay loam and silty clay loam	B	83	Clark County	180°	M	5	500	Well	226	50	32	8	55	25	152
Olympic clay loam and silty clay loam	C	25	Clark County	90°	M	10	600	Well	225	60	38	8	86	38	150
Olympic clay loam and silty clay loam	B	26	Clark County	225°		6	500	Well	226	60	38	6	90	39	153
Olympic clay loam and silty clay loam	B	117	Clark County	90°	U	8	900	Well	215	55	35	7	63	28	150
Olympic clay loam and silty clay loam	C	5	Lewis County	90°		11		Well					90	38	158
Olympic clay loam and silty clay loam	B	6	Lewis County	180°		7		Well					105	55	141
Olympic clay loam and silty clay loam	C	7	Lewis County	0°		10		Well					105	45	161
Olympic clay loam and silty clay loam	E	72	Lewis County	315°		35		Well					85	35	164
Olympic clay loam and silty clay loam	B	73	Lewis County	315°		5		Well					85	35	160
Olympic clay loam and silty clay loam	C	74	Lewis County	0°		12		Well					95	39	162
Olympic clay loam and silty clay loam	D	76	Lewis County	180°		17		Well					101	47	150
Olympic clay loam and silty clay loam	C	105	Lewis County	0°		10		Well					125	56	167
Olympic clay loam and silty clay loam	D	106	Lewis County	315°		20		Well					85	36	157

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Olympic clay loam and silty clay loam	C	118	Lewis County	0°		15		Well					100	42	162
Olympic clay loam and silty clay loam	C	119	Lewis County	90°		12		Well					102	45	157
Olympic clay loam and silty clay loam	F	127	Lewis County	180°		70		Well					115	52	162
Olympic clay loam and silty clay loam	A	01	Lewis County			3	550	Well	178	50	32	6	105	41	172
Olympic clay loam and silty clay loam	E	78	Lewis County	180°		33		Well					102	51	145
Olympic clay loam and silty clay loam	C	88	Cowlitz County	0°		15	400	Well	225	50	32	5	73	30	158
Olympic clay loam and silty clay loam	C	90	Cowlitz County	0°		10	400	Well	225	50	32	5	73	30	158
Olympic stony clay loam	B	132	Clark County	270°		4	400	Well	215	50	32	6	85	39	145
Olympic stony clay loam	D	114	Lewis County	270°		18	420	Well	227	50	32		100	52	140
Olympic stony clay loam	D	170	Cowlitz County	180°		25		Well					84	40	140
Olympic stony clay loam	C	175	Cowlitz County	180°		15		Well					106	55	143
Olympic stony clay loam	E	178	Cowlitz County	180°		40		Well					98	49	142
Olympic stony clay loam	C	179	Cowlitz County	225°		12		Well					106	53	146
Onalaska silt loam	A	20	Lewis County			3	250	Imperfect	230	45	26		123	43	197
Onalaska silt loam	A	21	Lewis County			2	250	Imperfect	230	45	26		130	50	187
Onalaska silt loam	A	38	Lewis County			2	200	Imperfect	230	45	26		105	49	151
Onalaska silt loam	A	40	Lewis County			2	200	Imperfect	230	45	26		115	50	164
Onalaska silt loam	A	43	Lewis County			2	200	Imperfect	230	45	26		80	34	195
Onalaska silt loam	A	44	Lewis County			1	200	Imperfect	230	45	26		105	46	158
Onalaska silt loam	A	45	Lewis County			2	200	Imperfect	230	45	26		150	86	160
Parkdale silt loam	B	8	Skamania County	90°	L	4	2300	Well	160	100	60	5	103	50	147
Parkdale silt loam	B	9	Skamania County	180°	L	7	2200	Well	158	100	60	5	116	60	149
Parkdale silt loam	B	10	Skamania County	270°	L	7	2300	Well	157	100	60	5	103	53	143
Prindle sandy loam	A	7-207	Skamania County			1	100	Imperfect	290	60	38	5	90	74	103
Prindle sandy loam	A	90X	Skamania County			1	60	Imperfect	293	60	38	8	72	68	85
Puyallup silt loam	A	39	Lewis County		L	1	100	somewhat ex.	288	45	26		120	42	192
Puyallup silt loam	A	42	Lewis County		L	1	100	somewhat ex.	288	45	26		120	47	180
Riffe sandy loam		11	Skamania County			1		Well	200	65	38	5	75	32	154
Roper gravelly loam	A	52	Clark County		L	2	250	Excessive	200	50	32	6	89	42	143
Roper gravelly loam	A	105	Clark County		L	2	200	Excessive	200	50	32	6	62	28	148
Roper gravelly loam	A	100	Clark County		L	2	100	Excessive	200	50	32	6	93	48	137
Roper gravelly loam	A	78	Clark County			1	200	Excessive	200	50	32	8	80	41	132
Roper gravelly loam	B	13	Cowlitz County	270°	L	8	120	Excessive	200	60	38	6	88	42	142
Roper gravelly loam	B	15	Cowlitz County	270°	L	4	100	Excessive	200	60	38	6	72	33	144
Salkum silty clay loam and clay loam	C	53	Lewis County	225°		14	400	Imperfect	230	50	32		90	37	162
Salkum silty clay loam and clay loam	A	59	Lewis County	0°		3	400	Imperfect	230	50	32		100	48	148
Salkum silty clay loam and clay loam	A	63	Lewis County	180°		3	400	Imperfect	230	50	32		105	49	152
Salkum silty clay loam and clay loam	C	70	Lewis County	90°		12	400	Imperfect	230	50	32		95	44	148
Salkum silty clay loam and clay loam	B	89	Lewis County	180°		7	400	Imperfect	230	50	32		105	46	158
Salkum silty clay loam and clay loam	B	91	Lewis County	270°		4	400	Imperfect	230	50	32		100	47	148
Salkum silty clay loam and clay loam	D	92	Lewis County	270°		25	350	Imperfect	230	50	32		120	62	152

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION PLOT No.	COUNTY	ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8 ANNUAL	AVERAGE PRECIPITATION 8 GROWING SEASON	No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
Salkum silty clay loam and clay loam	D	97	Lewis County	135°		18	350	Imperfect	230	50	32		112	50	160
Salkum silty clay loam and clay loam	D	103	Lewis County	90°		20	350	Imperfect	230	50	32		121	54	166
Salkum silty clay loam and clay loam	B	108	Lewis County	90°		6	400	Imperfect	230	50	32		100	48	148
Salkum silty clay loam and clay loam	E	110	Lewis County	0°		40	350	Imperfect	230	50	32		80	34	155
Salkum silty clay loam and clay loam	D	111	Lewis County	180°		25	350	Imperfect	230	50	32		88	37	158
Salkum silty clay loam and clay loam	E	112	Lewis County	180°		45	350	Imperfect	230	50	32		102	47	152
Salkum silty clay loam and clay loam	B	113	Lewis County	180°		6	400	Imperfect	230	50	32		115	50	164
Salkum silty clay loam and clay loam	B	125	Lewis County	90°		5	400	Imperfect	230	50	32		95	41	155
Salkum silty clay loam and clay loam	A	128	Lewis County			3	400	Imperfect	230	50	32		107	51	152
Salkum silty clay loam and clay loam	A	134	Lewis County			3	400	Imperfect	230	50	32		102	48	150
Salkum silty clay loam and clay loam	B	28	Clark County	0°	M	7	360	Imperfect	220	50	32	5	101	42	163
Salkum silty clay loam and clay loam	A	131	Clark County			2	500	Imperfect	210	55	35	6	79	34	153
Salkum silty clay loam and clay loam	B	22	Clark County	270°	M	5	475	Imperfect	210	50	32	6	87	37	156
Salkum silty clay loam and clay loam	A	86	Clark County			1	800	Imperfect	200	55	35	9	43	20	165
Salkum silty clay loam and clay loam	A	58	Clark County			2	650	Imperfect	206	60	38	5	89	37	160
Salkum silty clay loam and clay loam	D	97	Clark County	180°	U	25	520	Imperfect	210	50	32	9	96	41	157
Salkum silty clay loam and clay loam	A	102	Clark County			1	650	Imperfect	206	60	38	5	86	39	147
Salkum silty clay loam and clay loam	C	42	Clark County	225°	M	10	700	Imperfect	204	60	38	6	97	40	162
Salkum silty clay loam and clay loam	A	85	Clark County			2	800	Imperfect	200	50	32	7	69	29	158
Salkum silty clay loam and clay loam	B	54	Cowlitz County	0°	U	5	500	Imperfect	210	56	35	5	109	50	156
Salkum silty clay loam and clay loam	B	03	Lewis County			5	400	Imperfect	230	50	32	5	129	63	163
Salkum silty clay loam and clay loam	C	8	Lewis County	0°		12	400	Imperfect	230	50	32		108	53	149
Salkum silty clay loam and clay loam	D	12	Lewis County	180°		16	375	Imperfect	230	50	32		105	51	149
Salkum silty clay loam and clay loam	A	17	Lewis County			2	400	Imperfect	230	50	32		110	51	155
Salkum silty clay loam and clay loam	A	18	Lewis County			1	400	Imperfect	230	50	32		115	56	154
Salkum silty clay loam and clay loam	A	31	Lewis County	180°	U	11	500	Imperfect	227	53	33		110	48	161
Salkum silty clay loam and clay loam	A	32	Lewis County			1	400	Imperfect	230	50	32		80	33	159
Salkum silty clay loam and clay loam	A	33	Lewis County			2	400	Imperfect	230	50	32		175	150	160
Salkum silty clay loam and clay loam	A	35	Lewis County			2	400	Imperfect	230	50	32		110	53	151
Salkum silty clay loam and clay loam	A	46	Lewis County			2	400	Imperfect	230	50	32		105	47	157

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Salkum silty clay loam and clay loam, shallow	A	10	Lewis County			3	400	Imperfect	230	50	32		93	52	130
Salkum silty clay loam and clay loam, shallow	A	11	Lewis County			3	400	Imperfect	230	50	32		70	36	129
Salkum silty clay loam and clay loam, shallow	A	34	Lewis County			2	400	Imperfect	230	50	32		100	49	144
Salkum silty clay loam and clay loam, shallow	C	102	Lewis County	180°		10	375	Imperfect	230	50	32		100	54	138
Salkum silty clay loam and clay loam, shallow	C	104	Lewis County	180°		10	375	Imperfect	230	50	32		82	40	137
Salkum silty clay loam and clay loam, shallow	C	109	Lewis County	45°		11	375	Imperfect	230	50	32		72	36	131
Salkum silty clay loam and clay loam, shallow	D	120	Lewis County	90°		18	350	Imperfect	230	50	32		112	60	144
Salkum silty clay loam and clay loam, shallow	E	3	Lewis County	90°		42	350	Imperfect	230	50	32		90	43	144
Salkum silty clay loam and clay loam, shallow	B	-L	Lewis County			3	400	Imperfect	230	50	32	5	82	42	132
Salkum silty clay loam and clay loam, shallow	C	31	Clark County	180°	U	10	500	Imperfect	227	50	32	5	73	35	138
Salkum silty clay loam and clay loam, shallow	D	91	Cowlitz County		Top	2	400	Imperfect	230	50	32	5	77	35	145
Salkum silty clay loam and clay loam, deep	A	-L	Lewis County			3	400	Imperfect	230	50	32	5	137	54	188
Salkum silty clay loam and clay loam, deep	C	93	Lewis County	315°		12	350	Imperfect	230	50	32		120	53	167
Salkum silty clay loam and clay loam, deep	E	94	Lewis County	270°		35	450	Imperfect	230	50	32		120	50	172
Salkum silty clay loam and clay loam, deep	C	95	Lewis County	45°		10	500	Imperfect	225	55	35		128	50	184
Salkum silty olay loam and clay loam, deep	C	96	Lewis County	270°		10	500	Imperfect	225	55	35		140	59	182
Salkum silty clay loam and clay loam, deep	B	90	Lewis County	0°		"	350	Imperfect	230	50	32		110	44	172
Salkum silty clay loam and clay loam, deep	C	124	Lewis County	0°		15	450	Imperfect	230	53	33		115	47	172
Salkum silty olay loam and clay loam, deep	C	123	Lewis County	90°		14	450	Imperfect	230	53	33		127	52	178
Salkum silty clay loam and clay loam, deep	E	50	Cowlitz County	135°	M	36	500	Imperfect	225	70	44	5	109	41	179
Sara silt loam	A	44	Clark County	45°	L	2	275	Imperfect	245	40	24	6	79	44	123
Sara silt loam	B	67	Clark County	180°	L	8	275	Imperfect	245	40	24	8	94	50	134
Scammon silt loam, deep	A	38	Clark County	180°	L	3	660	Poor	215	60	38	5	107	43	170
Scammon silt loam	A	40	Clark County	180°		2	700	Poor	213	60	38	6	105	39	177
Scammon silt loam	B	41	Clark County	270°	M	4	480	Poor	220	60	38	7	85	35	160
Scammon silt loam	A	55	Clark County			1	875	Poor	208	60	38	8	97	38	170
Scammon silt loam	E	1	Cowlitz County	90°	M	50	1000	Poor	204	65	41	5	150	79	167
Scammon silt loam	B	9	Cowlitz County	225°	Top	8	1550	Poor	189	60	38	6	93	39	159
Scammon silty clay loam	B	69	Clark County	270°	U	4	400	Poor	214	60	38	6	72	34	140
Scammon silty clay loam	A	133	Lewis County	180°		3	350	Poor	215	48	30		105	57	138
Scammon silty clay loam	A	39	Clark County	180°	L	3	670	Poor	206	50	32	5	73	32	150
Scammon silty clay loam	A	53	Clark County			3	475	Poor	212	50	32	7	82	37	147
Scammon silty clay loam	B	16	Cowlitz County	45°	M	8		Poor		60	38	6	72	31	152
Scammon silty clay loam	B	22	Cowlitz County	270°	M	7	200	Poor	217	50	32	6	80	35	150

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION PLOT No.	COUNTY	ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8 ANNUAL	GROWING SEASON	No. OF TREES MEASURED 9	AVG. HT OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
Seaquest clay loam	D	8	Cowlitz County	270°	M	20	1400	Well	198	60	38	6	103	40	172
Seaquest clay loam		32	Cowlitz County		Top	2	500	Well	225	50	32	4	114	49	166
Seaquest clay loam	A	36	Cowlitz County		Top	3	500	Well	225	50	32	5	114	46	173
Seaquest clay loam	A	33	Cowlitz County	180°	Top	3	500	Well	225	50	32	5	127	53	176
Seaquest clay loam	C	89	Cowlitz County	0°		10	800	Well	207	55	35	5	93	36	171
Skamokawa silt loam	B	15	Pacific County			5	380	Mod. Well	235	90	60	7	83	33	165
Skamokawa silt loam	B	16	Pacific County			5	380	Mod. Well	235	90	60	6	91	36	193
Stabler shotty loam	D	49	Skamania County	220°	M	16	1240	Well	180	60	40	5	73	50	103
Stabler shotty loam	B	3	Skamania County	45°	U	5	1150	Well	180	60	40	5	66	43	105
Stabler silt loam	D	106	Cowlitz County	195°	M	27	2100	Well	155	70	50	5	107	74	122
Stevenson clay loam	B	12	Cowlitz County			5	100	Well	222	60	38	5	126	79	140
Stevenson clay loam	D	35	Cowlitz County	180°	M	25		Well	222	50	32	6	93	47	138
Stevenson clay loam	D	104	Cowlitz County	270°	U	22	1200	Well	195	50	32	6	56	27	140
Stevenson gravelly clay loam	B	26	Cowlitz County	270°	M	7	150	Well	222	60	38	6	110	65	135
Stevenson stony loam	F	48	Skamania County	160°	L	53	700	Well	204	55	35	5	81	42	130
Stevenson stony loam	B	25	Skamania County	135°	M	5	1190	Well	180	60	38	5	91	43	144
St. Martins clay loam	D	1	Skamania County	90°	M	25	700	Mod. Well	180	87	55	5	77	54	105
Tebo loam	C	10	Grays Harbor County	225°	U	15	300	Well	200	70	50	7	72	27	180
Tebo clay loam	B	11	Grays Harbor County	90°	M	7		Well	200	70	50		108	44	168
Toutle loamy sand	A	158	Cowlitz County			2	100	Excessive	222	50	32		105	54	144
Toutle loamy sand	A	159	Cowlitz County			2	100	Excessive	222	50	32		110	52	154
Toutle loamy sand	A	160	Cowlitz County			2	100	Excessive	222	50	32		110	52	154
Toutle loamy sand	A	177	Cowlitz County			1	100	Excessive	222	50	32		118	53	163
Toutle loamy sand	A	80	Cowlitz County			1	300	Excessive	216	60	38	5	64	28	152
Toutle loamy sand	B	78	Cowlitz County			6	500	Excessive	210	60	38	6	119	61	151
Toutle loamy sand	A	144	Cowlitz County			1	100	Excessive	222	50	32	6	114	55	154
Toutle loamy sand	A	140	Cowlitz County			2	50	Excessive	222	55	32	6	111	50	158
Toutle loamy sand	A	76	Cowlitz County			1	80	Excessive	222	55	38	5	99	53	137
Toutle loamy sand		41	Cowlitz County			1	80	Excessive	222	55	38	5	104	52	146
Toutle loamy sand	A	5	Cowlitz County			1	540	Excessive	210	100	63	6	100	49	144
Vader loam	F	67	Cowlitz County	180°	M	55	350	Well	210	50	32	5	61	24	180
Vader loam	D	OX	Cowlitz County	90°	M	25	300	Well	210	50	32	5	142	56	190
Viola clay loam	D	10	Cowlitz County	225°	Top	25	990	Poor	190	65	38	5	90	42	145
Viola clay loam	D	20	Cowlitz County	270°		30	60	Poor	220	60	38	6	94	44	147
Viola clay loam	B	25	Cowlitz County			4	100	Poor	220	60	38	5	132	78	148
Viola clay loam	C	29	Cowlitz County	270°	U	12	1600	Poor	172	50	32	6	95	44	149
Viola clay loam	C	30	Cowlitz County	270°	M	15	1600	Poor	172	50	32	5	100	45	153
Viola clay loam	A	31	Cowlitz County		Top	2	1600	Poor	172	50	32	6	82	36	150
Wadell stony silty clay loam	F	50	Grays Harbor County	180°	L	50	370	Well	235	56	35	5	149	89	178
Wadell stony silty clay loam	A	24	Thurston County	350°	M	3	300	Well	235	55	35	5	100	40	167
Wapato silty clay loam	A	146	Lewis County		L	1	225	Poor	233	46	28		95	58	125
Wind River gravelly loam	B	10	Skamania County	125°	M	7	480	Well	200	60	38	5	102	59	133
Wind River silt loam	C	9	Skamania County	125°	M	10	500	Well	200	60	38	5	122	65	150

APPENDIX - TABLE 1 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA *(continued)*

TREE SPECIES DOUGLAS FIR

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Winlock silty clay loam	A	61	Lewis County	90°	U	3	350	Well	220	50	32		120	49	175
Winlock silty clay loam	A	62	Lewis County	270°	U	2	350	Well	220	50	32		150	76	170
Winston gravelly loam	A	15	Lewis County			2	250	Excessive	230	50	32		120	54	164
Winston gravelly loam	B	37	Lewis County	0°		4	180	Excessive	230	50	32		110	45	169
Winston gravelly loam	A	41	Lewis County			2	200	Excessive	230	50	32		100	46	152
Winston gravelly loam	A	54	Lewis County	180°		2	200	Excessive	230	50	32		112	51	158
Winston gravelly loam	A	77	Lewis County			2	230	Excessive	230	50	32		110	52	156
Winston gravelly loam	B	85	Lewis County	270°		7	250	Excessive	230	50	32		110	53	152
Winston gravelly loam	D	86	Lewis County	270°		16	250	Excessive	230	50	32		110	53	152
Winston gravelly sandy loam	A	14	Lewis County			2	250	Excessive	230	50	32		85	44	133
Winston gravelly sandy loam	A	16	Lewis County			1	250	Excessive	230	50	32		105	53	144
Winston gravelly sandy loam	A	79	Lewis County			1	250	Excessive	230	50	32		66	34	128
Yacolt silt loam	A	122	Clark County			2	440	Well	212	70	44	6	73	31	154
Yacolt silt loam	B	108	Clark County	0°	M	4	700	Well	195	60	38	6	82	33	162
Yacolt silt loam	B	85	Clark County	270°		5	700	Well	195	60	38	5	75	33	150
Yacolt silt loam	C	LDX	Clark County	165°		14	500	Well	210	70	44	5	96	44	150

APPENDIX - TABLE 2 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA

TREE SPECIES WESTERN HEMLOCK

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Astoria silty olay loam	C	3	Paoifio County	39°		10	350	Well	250	90	50	5	115	51	178
Astoria silty olay loam	B	4	Paoifio County	270°		7	450	Well	250	90	50	6	118	60	161
Astoria silty olay loam	B	5	Paoifio County	0°		5	500	Well	245	90	50	6	121	61	166
Astoria silty olay loam	D	18	Pacifio County	140°	M	22	300	Well	250	110	61	5	185	102	183
Astoria silty olay loam	C	6	Wahkiakum County	160°	M	15	250	Well	252	90	50	5	123	58	176
Astoria silty olay loam	F	9	Wahkiakum County	320°	M	73	75	Well	255	95	52	5	132	63	175
Astoria silty olay loam	C	15	Grays Harbor County	225°	U	13	100	Well	255	78	43	5	111	58	156
Astoria silty clay loam	C	18	Grays Harbor County	270°	U	10	50	Well	255	80	44	5	95	43	159
Astoria silty olay loam	E	14	Grays Harbor County	180°	U	33	50	Well	255	78	43	5	84	40	162
Astoria silty olay loam	D	1	Paoifio County	270°	U	17	250	Well	249	75	43	6	104	54	156
Astoria silty olay loam	D	2	Paoifio County	90°	M	25	300	Well	247	75	43	5	129	57	184
Astoria silty olay loam	B	20	Paoifio County	180°	L	5	400	Well	244	90	50	6	169	86	184
Astoria silty clay loam	A	19	Pacifio County		M	7	350	Well	245	110	61	3	168	100	188
Brenner silt loam	A	6	Paoifio County	0°	L	1	250	Poor	250	100	55	6	130	52	200
Copalis gravelly silt loam	B	21	Grays Harbor County	90°		6	50	Well	250	90	57	5	115	58	161
Hoquiam silt loam	A	12	Grays Harbor County			3	65	Well	235	76	42	5	102	44	180
Hoquiam silt loam	B	13	Grays Harbor County	135°	U	5	60	Well	235	78	43	5	133	67	164
Hoquiam silt loam	A	19	Grays Harbor County			1	50	Well	235	80	44	5	95	43	173
Hoquiam silt loam	B	20	Grays Harbor County	180°	U	7	250	Well	229	85	47	5	121	55	177
Hoquiam silt loam	B	22	Grays Harbor County	0°		4	50	Well	235	85	47	5	91	38	190
Knappa silt loam (	E	1	Wahkiakum County	330°	M	45	750	Well	210	90	50	5	132	56	189
Knappa silt loam) high	D	2	Wahkiakum County	120°	M	22	750	Well	210	90	50	5	125	56	181
Knappa silt loam (rainfall	F	3	Wahkiakum County	25°	M	65	750	Well	210	90	50	3	132	60	181
Knappa silt loam)	E	7	Wahkiakum County	170°	M	40	800	Well	207	95	52	5	94	41	180
Knappa silt loam	C	11	Wahkiakum County	135°	U	15	300	Well	222	100	55	4	128	50	201

APPENDIX - TABLE 3 SOIL - WOODLAND SITE CORRELATION PLOT DATA FOR SOUTHWEST WASHINGTON AREA

TREE SPECIES RED ALDER

SOIL SERIES, TYPE, AND PHASE	SLOPE CLASS 1	PLOT IDENTIFICATION		ASPECT 2	PLOT POSITION 3	AVERAGE SLOPE GRADIANT 4	PLOT ELEVATION 5	SOIL DRAINAGE CLASS 6	FROST FREE DAYS 7	AVERAGE PRECIPITATION 8		No. OF TREES MEASURED 9	AVG. HT. OF TREES IN PLOT 10	AVG. AGE OF TREES IN PLOT 11	SITE INDEX 12
		PLOT No.	COUNTY							ANNUAL	GROWING SEASON				
Cinebar silt loam	C	107a	Cowlitz County	5°	M	14	1000	Well	193	70	44	4	103	63	112
Cloquallum silt loam	B	203a	Mason County	290°	M	8	120	Imperfect	200	75	47	4	83	49	83
Gee silt loam	B	102a	Cowlitz County	270°	M	5	200	Mod. Well	241	45	28	5	87	31	70
Olympic clay loam	C	103a	Cowlitz County	0°	M	10	500	Well	225	45	26	5	73	33	61
Olympic clay loam	C	105a	Cowlitz County	135°	M	12	1200	Well	200	50	32	6	98	50	98

FOOTNOTES TO APPENDIX TABLES 1,2 and 3:

Column 3 - Plot position.
U - Upper slope
M - Mid slope
L - Lower slope
F - Flat

Column 4 - Slope gradient in percent.

Column 7 - Frost Free Days - Length of growing season at 28° F.

Blank spaces indicate data lacking.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